

April 8, 1957

50 Cents

AVIATION WEEK

A McGRAW-HILL PUBLICATION

Soviet Bear Engine Design Is Described
•
Missile Launcher Would Test Thrust



Sikorsky HR2S-1 Lifts Bridge



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Convair's 880 Jet-Liner, powered by General Electric CJ-865 engines, will be delivered to leasing airlines* for world-wide service beginning in 1959. In this new era of jet transportation, Convair's innovative 880 Jet-Liner will be the world's fastest passenger plane—Indy master of the skies!

CONVAIR

A DIVISION OF GENERAL DYNAMICS CORPORATION

*Airline services to date under Convair 880 Jet-Liner include: Pan Am • TWA • American • United



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TYPE MB-1 AIR CONDITIONER

Stratos' experience with airborne air conditioning systems has been applied to a new, lightweight air conditioner designed for use with gas turbine compressors such as the MA-1A and MA-2 types. Meeting Type MB-1 requirements, the unit is Stratos' Model GEA-126-1.

Composed of aircraft quality components, the system is packaged as a compact unit measuring only 48" x 59" x 39". The controls—connected to the package solely by an electrical cable—can be remotely located and, where desired, taken directly into the aircraft.

For additional data on Stratos' line of air conditioning systems, write to:

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A DIVISION OF FRAMCO ENGINE & AIRCRAFT CORPORATION

White Plains, New York 10602 • Memphis, Tenn. • Milwaukee, Wash., Calif.



Stratos' Model GEA-126-1 air conditioning units being prepared for production test.



THIN-WALL suggestion waiting for the Register article; as produced by Doss.

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Plastics Sales Div., Co.
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AVIATION CALENDAR

Apr. 8-11—1976 Wright Show, Staton Hotel, Philadelphia, Pa.

Apr. 8-10—Annual Int. sepolia seventh meet will be, electrical and electronic parts sales, 10 a.m. to 4 p.m., Convention Auditorium, Convention Center, 2nd & C, Philadelphia, L. I. N.Y.

Apr. 10-13—National Nuclear Instrumentation, Conference and Trade Show Southern California Institute of Technology, Los Angeles, Calif.

Apr. 10-13—Electro-Expo '76, Atlanta, Ga.

Apr. 13-15—Flight Testers, "Very High Frequency Applications," NASA, Fermentation, Society of Experimental Test Pilots, Los Gatos, Calif.

Apr. 14-16—1976 National Symposium on Telecommunications, sponsored by the Institute of Radio Engineers, Professional Council on Telephony, and Research Council Staton Hotel, Philadelphia, Pa.

Apr. 15-17—Symposium on Systems for Industrial Reinforcement, sponsored by Westinghouse Electric Corp., Boston Auditorium, Chestnut Hill, Mass.

Apr. 16-18—1976 Annual Meeting on Nuclear Safety in Nuclear Reactor Design, Missouri Int'l, Chicago, Ill.

Apr. 21-24—Several Int'l. Job Fairs by Daniels Symposium, Hotel Statler, Boston, Mass.

Apr. 21-23—Electro-Expo '76, Atlanta, Ga.

Apr. 21-23—Mobile Services, New York Regional Association of Electrical Engineers, 7-10 p.m., 35 W. 47th St., New York, N.Y.

Apr. 23-25—1976 Conversion, Internat'l. Sales, Niagara Falls, Canada, Pittsfield, N.Y.

Apr. 26-May 1—Test Instruments and Symposium, Statler Hotel, San Antonio, Tex.

Apr. 28-May 3-4—1976 Annual National Conference, Society of Agricultural Weight Engineers, Statler Hotel, Hot Springs, Ark.

May 1-2—1976 Water Quality Rate Determination on Test Items 60.

AMERICAN JOURNAL OF DENTISTRY



Vol. 44 No. 1

Consequently, we have to add the following note to the original article:

Information: Please send form 2020-20 to **Address:** [REDACTED]

One in a series about users of Phillips 66 Aviation Products

Phillips 66

LOOKS AHEAD
with
BRANIFF

Important service for today and in the future is the goal of **Braniff International Airways' \$63 million aircraft expansion program**. Recently, Braniff placed the new DC-7C "B Dorado" in domestic service and plans to put three 250-seat aircraft into international service in 1967. In addition, Braniff has ordered 9 Lockheed Electra Turbo props for delivery in 1959 and five Boeing 707 jet transports for delivery in 1960 and 1961.



The new "El Bocodo" has an operational non-stop capacity of more than 5,000 miles. Reduction of noise and vibration, weather mapping radar and communication link electronic coach service are features of the new "El Bocodo".



Braniff's new 707 jet transports will operate these typical flying schedules: Dallas-Chicago, 1 hr., 35 min.; Houston-Chicago, 1 hr., 50 min.; Fort Worth-Washington, D. C., 2 hr., 15 mins.; Dallas-New York, 2 hr., 50 mins.



Today, Phillips 66 Aviation Gasoline gives dependable, efficient performance to Braniff and other leading air lines, as well as to the many car services.

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TEMPERATURE RESISTORS
for Temperature Telemetering**

- * NO THICKER THAN A PIECE OF TAPE
- * OUTPUT UP TO 2 VOLTS WITHOUT AMPLIFICATION
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- * RESISTANCE CHANGE OF 100 OHMS OVER SPECIFIED RANGE
- * NO HOLES TO DRILL—QUICK AND EASY "TAPE-ON" INSTALLATION

Trans-Sonics Type 1371 "Tape-on" Surface Temperature Resistors are precision resistance thermometers with a platinum resistance winding as the sensing element. These resistors which are no thicker than a piece of tape may be applied to any surface whose temperatures are to be measured. In a compensation circuit, they eliminate standard thermocouple transistors without amplification. The new Type 1371 "Tape-on" Surface Temperature Resistors may be added to an installation using other Trans-Sonics temperature transducers without any further circuit modification. Each resistor is furnished with 6" long fibreglass-covered insulation leads. Write for Bulletin 1371 to Trans-Sonics, Inc., Dept. 7.

See Telephone

SPECIFICATIONS

IEEE NIST N°

Accuracy: ±0.2% of full scale range

Resolution: 0.01% of full scale range

Response Time: 0.001 sec.
(measured over 1 second)

Environmental Operation Conditions:
Wavelength: 1.7 double wavelength,
0.85 mm

Depth: 1000 ft in any direction per photograph #121 of MIL-R-3272A (20 millidynes shear)

**INSTANT
INSTALLATION**



As easy to apply
as a thumb print!

For Troubleshooting, See Trans-Sonics

Trans-Sonics, Inc.

P. O. BOX 231

LEXINGTON MA 02143

AVIATION CALENDAR

(Continued from page 4)

Read Meeting, International Air Transport Assn., Tampa, December, Eng. and

April 20—Inauguration Mile for Helicopter
Fl., several action meetings, New York
Meeting, American Institute of Electrical
Engineers, 33rd year, 11 W. 39th St.
New York, N.Y.

May 2-3—Electro-Mechanical and Radar Sym-
posium for Experimental Radar Analysis
Hotel Statler, Boston, Mass.

May 15-17—Government Aviation Assn.
Annual Airplane Meeting, Shreveport, La.

May 15-19—Aircraft Meeting, Army Materiel
Com., Von, Buckley Brown Hotel, Denver,
Colo.

May 19—Electrical Engineering Agents of
the Armed Forces Meeting, American Institute
of Electrical Engineers, Belmont Hotel,
Detroit, Mich.

May 21-22—Annual National Forum,
American Electronics Society, Statton
Hall Hotel, Washington, D.C.

May 21-23—National Conference on Avia-
tional Photonics, Sponsored by the
Institute of Radio Engineers, Dayton,
Ohio.

May 21-27—Int'l. Air Show Committee,
An International Division, American Society
of Cinematographers, Park Avenue Hotel,
New York.

May 26-28—Annual Aviation Fire Safety
Seminar, National Fire Protection Assn.
Hotel Statler, Los Angeles, Calif.

May 26-28—Aerospace Prod. & Servs., Se-
cured by French American Convention, Le
Bouygues Airport, Paris.

June 1-3—Annual Maintenance and Oper-
ation Meeting for Reservoir and Entry
Int'l. Aircraft Owners, sponsored by
Boeing Commercial Services, Boeing Main
Op. Center, Pa.

June 1-3—First Annual National Aviation
Trade Show, Minneapolis County Fair Grounds.

June 17-20—National Seminar Meeting, In
stitute of the Aerospace Sciences, 36th
annual, Hotel, Los Angeles, Calif.

June 23-25—Annual Meeting, Aviation
Technicians & Maintenance Assn., The
Shawnee Inn, Colorado Springs, Colo.

June 24-28—National Aviation Day
Minnes.

July 2-4—1965 National Safety Council
Elgin, Ill.

July 22-25—Sixth International
Aeronautical Congress, the National Av
Society (fifth model) and the Royal Aeronautic
Society, London, England.

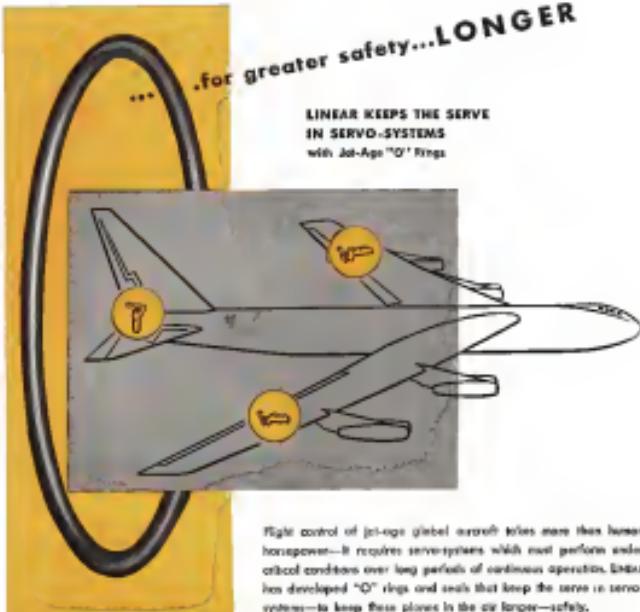
Aug. 10-11—Winter Electron Show &
Exposition, Cow Palace, San Francisco, Calif.

Sept. 24-26—Sixth International Aerospace
Conference, Royal Aeronautical Society
Farnborough and London, England.

Sept. 24-26—Young Doctor, Society of
British Medical Engineers, Farnham
Wells, England.

Nov. 7-8—Western Section Management
Meeting, Statler Hilton Hotel, Denver.

Dec. 11—Wright Brothers Lecture Depart-
ment of Ceramic Materials, Wash-
ington, D.C.



...for greater safety...LONGER

**LINEAR KEEPS THE SERVE
IN SERVO-SYSTEMS**
with Jet-Age "O" Rings

Right control of jet-age gimbled aircraft takes more than human horsepower—it requires servosystems which must perform under critical conditions over long periods of continuous operation. LINEAR has developed "O" rings and seals that keep the serve in servo-systems—to keep these planes in the air longer—safely.

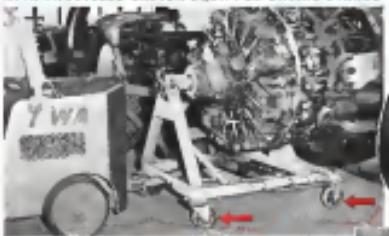
For these critical requirements, LINEAR developed precision "O" rings selected from the newest elastomers to meet the most rigid specifications. They will withstand temperatures of from -130° to 550°F—give long service life under severe mechanical abuse—and will withstand the destructive action of such fluids as alkalis and photo-
graphic emulsions, hydrocarbons and synthetic lubricants.

When it's a sealing problem, call on LINEAR or one of its agents for engineering assistance...and be sure to specify LINEAR "O" Rings.



HOW **Faultless** AIRMASTER CASTERS ARE SERVING AVIATION

TRANS WORLD AIRLINES GETS SAFE, FAST RESULTS WITH FAULTLESS CASTER EQUIPPED ENGINE STANDS



AIRMASTER Series 400 Faultless Caster is shown here. It features a unique system of balanced bearings centered around larger diameter of casters.

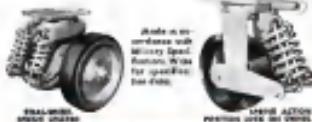
Roller bearing, ball bearing, roller fluid, steel, aluminum, steel, brass, steel or flexible wheels are also available to suit load and wear requirements.



This Photo shows engine canted, with Faultless Caster transport and a worker stands in foreground.

Huge Super Constellation engines are easily moved on Faultless Casters several hundred feet to the TWA overhang area. There they are transferred to special Faultless Caster stands, allowing engines to be rotated horizontally or vertically for maximum maneuverability. The engines and stands move along a production line of several stations where specific work is done on them. At many air bases 100 engines are on stands at one time. Faultless Casters not only permit fast aircraft handling but the 21" wheel face protects the plant's floors. The advantages of this type of aircraft handling equipment are numerous, shorten the turnaround process, a combined weight saving and storage dolly. Your local Faultless Distributor can recommend similar time and money saving methods for you, no obligation.

Two of many Shock Absorbing AIRMASTER Casters produced for the Aviation Industry



Made in accordance with Aeronautical Service Circular 1000, Part 1000, for specified load rates.

LIGHT ACTION POSITION HIPS ON DOLLY

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Los Angeles, New Orleans, New York, Philadelphia, Portland, Seattle, St. Louis (Cincinnati Hydroform Divisions).

MOVING METAL... BLUE ANGELS' Style



U.S. NAVY PHOTO

With instantaneous separation of five feet between each plane, the "Blue Angels" demonstrate precision tactical techniques of naval aviation at speeds of 500 mph and better. This famous team of Navy pilots has thrilled millions of aviation enthusiasts with its "minimum altitude" performances of close orbit precision flying.

To a constantly increasing number of manufacturers, particularly aircraft and aerospace builders, moving metal by The Cincinnati Milling Machine Company's Hydroforming and Hydrospinning processes is equally dramatic. Formerly difficult-to-make aircraft, engine, missile and other components are being produced in rapid development time... with savings of 30% and more in tooling, materials and labor. These part shapes range from simple to highly complex, formed from a wide range of metals. For detailed information on Hydroforming and Hydrospinning, call in a Process Machinery Division field engineer.



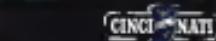
CINCINNATI 19" HYDROFORM®

JET ENGINE PART of 32 gauge Invar, Hydroformed in two operations. A punch, contoured to the part shape, and a single drive ring, were the only tools required. Hydroforming machines are built in 8", 12", 16", 20", 24" and 32" sizes.

NOZZLE Hydroform frame is wrapped and welded tube (shown at right) of A31 4130 steel in four passes. Hydroform parts, having undergone a severe shear deformation, possess increased strength, hardness and resistance to fatigue.



CINCINNATI 42" x 30" HYDROSPIN®



Hydroform • Hydrospin

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CINCINNATI, OHIO, U. S. A.

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A pilot firmly grasps a panel button. Whizpop tanks fill over—er, perhaps, fire-hoists for explosives take a burning magnesiumعتبر. He knows what to expect at any rate, because a tough, tiny Electro-Snap aircraft switch is behind the panel.

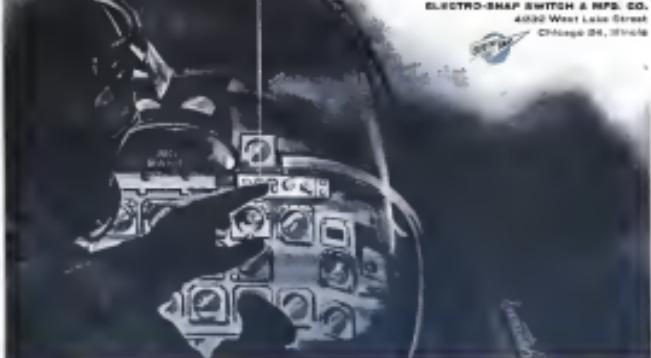
Because of G-loading, temperature, speed, altitude, or weather considerations, Electro-Snap switches, or weather "standards," deliver a known performance for a known number of operations—make certain of safe functioning for a predictable period of time.

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Electro-Snap "standards" switches are available for most requirements, and our engineers "specials" are solving many unique problems. If you have a switching problem, send it to us; our engineers will work with you closely in producing it in quantity economically. **THIS IS OUR ONLY BUSINESS!**

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and write for catalog material on our
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ELECTRO-SNAP SWITCH & MFG. CO.
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OPERATION from -40° to +80°F

An officer in charge of the Air Division of the Army's Aviation Test Center, Capt. Roy B. Katherinal became instantly acquainted with the first Bell helicopter ever seen in Alaska.

During next month of 1953-4, he logged over 500 hours in this 'copter, flying in the worst sort of weather with temperatures ranging from 48° below in 10° above. On one occasion he even flew with the thermometer registering -60°. The Bell, he reports, showed inferior stances and a much better than human ability to withstand cold and adverse weather.

A former pilot in both Europe and the Pacific during World War II, Capt. Katherinal is said to agree with the Globemaster Naval Guard at the outbreak of Korean hostilities. With over 1300 hours flying and 1600 hours using wing suspension in his cockpit, he is a Senior Army Aviator and typical of the officers who are devoting their careers to leading the strength and efficiency of Army Aviation at the Army Aviation Center, Ft. Rucker, Alabama.

Helicopter flight and mechanical training are available to qualified personnel at the U. S. Army Aviation School, Ft. Rucker, Alabama.

BELL
helicopter
FT. WORTH, TEXAS
Subsidiary of Bell Aircraft Corp.



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EARLY AND THE FLY HAD TWO SETS OF SENSES. The second set of wings shrivelled into the vibrating green antennae that tell him where he is. The fly also flies with his own inertial guidance system, efficient enough for his needs and marvelously compact. Our interest in the anatomy of the fly is

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SPACE SIMULATION EQUIPMENT



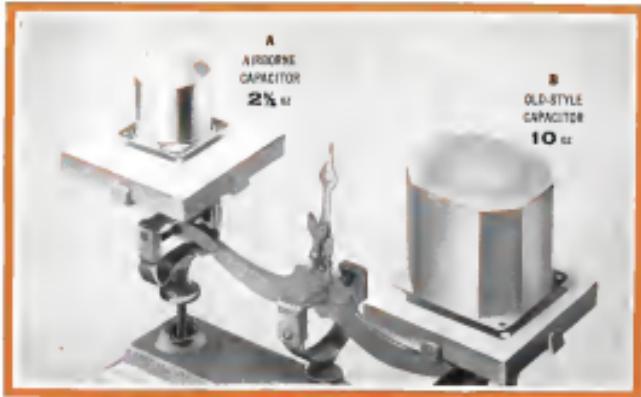
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Time is what sells dollars in the aviation industry... because precision time is needed by all travel. Similar to oil, sales average in terms, miles on **Sinclair Aircraft Oil**. The performance differences, time-wise, between dies and ordinary oils are patently. **Sinclair Aircraft Oil** saves time on the ground through reduced maintenance and overhaul... and in the air it saves time by preventing the full vibration of power. Indeed, its superiority is such that 45% of the aircraft oils used by major scheduled airlines in the U. S. is supplied by **Sinclair**. No better proof of dependable time-savings could be cited.

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- HAS TWICE THE CAPACITY AT TRIPLE THE VOLTAGE

We got into the custom capacitor and off-the-shelf business because we wanted lighter, smaller, more efficient capacitors and filters for our aircraft systems and couldn't find any. So we began making our own.

Using Mylar dielectric and a special technique, we have been able to make dramatic reductions in capacitor size and weight, while maintaining or increasing capacity and dielectric strength. The example above is typical.

Tried and proved in our own motors, these new miniaturized Airborne capacitors are now available.

able to help reduce the weight and bulk of your equipment. Various compensated with polymer coil and hermetically sealed in glass and case. Airborne capacitors have excellent resistance to vibration, fatigue, salt spray and humidity and retain their electrical characteristics throughout the temperature range -65° to +300° F. They meet government specifications JAN-C-82, MIL-S-4103B and MIL-M-8829.

Send for quotation on Airborne custom manufactured capacitors—and Airborne miniaturized r.f. filters.

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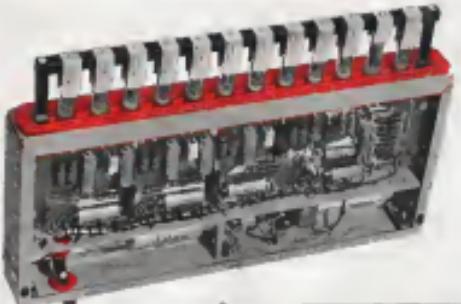
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Silastic parts are used in many of the first sound systems installed at Germany's new Berlin Wall. Because these remote controls at both high and low temperatures, some of the most critical design requirements specify that controls at 350°F. Relays are subjected to temperatures up to 350°F. and are also used without any problems at temperatures as low as -40°F. The requirement is to use flexible, high strength, flexible, Delrin and aluminum. Source: Elastomer Products Manufacturing Company, St. Louis.



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protects electronic packages on B-58

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Circle 6000 on Reader Service Card

Typical Properties of Silastic for Electrical Use

Temperature range, °F	-350 to 350
Tensile strength, psi	600 to 900
Elongation, %	200 to 300
Insulation Resistance, megohms/1000 h	1000 to 3000
Dielectric strength, volt/mil	300 to 500
Dielectric Constant, 10 ⁶ cycles per second, electrical	3.2

If you require all the properties of a silicone rubber, just specify SILASTIC.

First in silicones



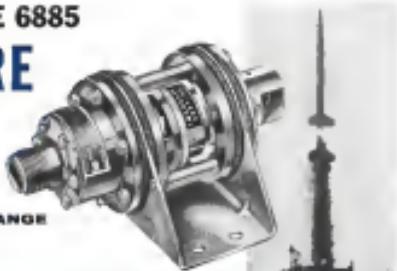
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VERSATILE TYPE 6885

PRESSURE SWITCH

ONE BASIC DESIGN

COVERS THE FULL RANGE
OF APPLICATIONS



PRESSURE ADJUSTMENT RANGE	10 to 20 psi	20 to 50 psi	2 to 10 psi	10-100 psi	50-100 psi	100-300 psi	100-500 psi	100-1000 psi	1000-2000 psi	2000-3000 psi
LIMITS OF SETTING Limits of set controlling										
PROST POSITION (position required)	100 psi	100 psi	700 or 1000 psi as required	700 or 1000 psi	700 or 1000 psi as required	700 or 1000 psi	700 or 1000 psi			
RESET POSITION	100 psi	100 psi								
TEMPERATURE LIMITS	100°F	100°F								
RESET										
SWITCH TYPE										
SWITCH POSITION										
WEIGHT	8 ounces	8 ounces	8 ounces	8 ounces	8 ounces	8 ounces	8 ounces	8 ounces	8 ounces	8 ounces
SWITCH SIZE										

This pressure controlled switch is particularly designed for aircraft, rockets and missiles to control electrical circuits whenever the system pressure deviates from set values.

Internal vibration insulation between mounting bracket and switch body minimizes errors in exceptional performance under vibrations and shock conditions. Switch performance remains well within the tolerance limits given in the above table.

The Type 6885 incorporates an enclosed snap-action switch, actuated by the movement of a long diaphragm. External adjustment of the control set point is easy with the user supplied fit operation. Standard position does not affect calibration. Other positions allow the switch adjustment range to define the desired range. The switch can be used to trigger switches, flip-flops or to control modulators like solenoids, relay coils, or Mal-D-Green 101. Only 80 mils of clearance contains the pressure switch.

An alternate Type 6885 Pressure Switch has two independent sensing and switch elements inside two housings with a single electrical connector and one pressure port. The Type 6885 can also be supplied with two electrical switches for double-pole, double-throw, non-conducive switch action.

The wide range of interesting pressures and functional perfection under vibration and shock make the Type 6885 Pressure Switch recommends it for a variety of airborne applications. For engineering assistance, please address your inquiry to our headquarters plant, Burbank, Conn.



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AIRCRAFT PRODUCTS DIVISION • DANBURY, CONNECTICUT • INGLEWOOD, CALIFORNIA

OUR AIRCRAFT PRODUCTS INCLUDE: THRUST ENGINE MANUFACTURE CONTROL AMPLIFIERS • ELECTRICAL AMPLIFIERS PRESSURE SWITCHES FOR REPORTS, JET ENGINES AND AIRFRAME APPLICATIONS • PRESSURE GAUGES • THERMOCOUPLE HYDRAULIC VALVES • JET ENGINE ATTENSHURM CONTROL SYSTEMS.

WESTERN GEAR SYSTEMS FLY WITH NEW LOCKHEED MODEL 1649 LUXURY LINER!

Reported world's longest range airplane, Lockheed's Model 1649 luxury liner can fly 8,300 miles nonstop without stopping for refueling. Wingspan of 190' is largest of any transport plane. Takeoff weight 100,000 lbs. Cruising speed 320 mph. Total passengers 22-40.

Even-lab actuators at rivets, welds, adhesives and bolted welds

Hydraulic servo jacks, 2 in each wing section

Outboard servo jacks, 2 in each wing section

1 ton, 4 in each wing section

Western Gear's wing flap system on Lockheed's newest and largest luxury liner, Model 1649, uses bell servos to control 335 sq. ft. of wing flap area, helps take-off and landing. Western Gear has tab controls on both outboard rudders, elevators and ailerons and in maintaining steady, true flight.

A commitment to design and construct such important control systems is evidence of Lockheed faith in Western Gear. Western Gear expertise is absurdly versatile—every major aircraft flying today, both commercial and military. Take advantage of 40 years of service to the aviation industry. Call on a Western Gear aircraft specialist for recommendations. Address General Office, Western Gear, P.O. Box 182, Laramie, California.

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PLAINTIFF LAMMERS, HARRIS, REED & CO., INC. v. DEFENDANT WESTERN GEAR SYSTEMS, INC. PREVIOUS EDITIONS



ENGINEERS AND MANUFACTURERS

APRIL 8, 1967

AVIATION WEEK

VOL. 66, NO. 14

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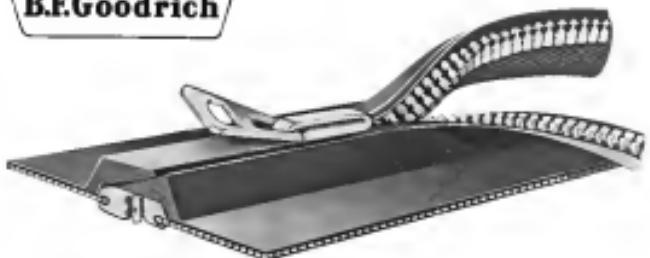
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B.F. Goodrich



B. F. Goodrich zipper seals tight, zips open fast



With only a zip, this zipper can press and seal up to 200 ft. of B. F. Goodrich Pressure Sealing Zippers from McDonnell Corp.



Baggage racks on Lockheed's L-1049 Constellation can open for servicing in 35 places, possibly saving safe loads.

B. F. Goodrich Pressure Sealing Zippers seal air, dust, fumes, and liquids—per zip open in seconds for access.

Notes above how molded rubber lips overlap with hermetic precision. They form a seal that tightens under external pressure and withstands any pressure up to the maximum strength of the zipper itself.

Pressure Sealing Zippers, which are made only by B. F. Goodrich, are used for air ducts, inspection ports, access doors, window gap seals and dozens of other uses. We're sure there's one for you.



BFG Pressure Sealing Zippers come in three basic types, all designed to solve nearly every zipper sealing problem. Write for free folder.

B.F. Goodrich Aviation Products
A division of the B.F. Goodrich Company, Akron, Ohio

EDITORIAL

The Value of Research

Today we are flying a noisy of Mach 2 fighters and a supersonic bomber that can zoom back into the early generation of Mach 1 interceptors. The North American F-107, the Republic F-105A, the Grumman F11F IF and the Lockheed F-104S are all fighters, nosefights, in the Mach 2 class. The Convair B-58 Hustler is the first truly supersonic bomber in the world. The U.S. also was the first to fly both heat and corner-based fighters capable of Mach 1 in level flight—USAF's North American F-102 and Navy's Douglas F4D. It also produced the first 1,000 mph camouflaged fighter in the Convair Vought F8U Crusader.

All of these achievements during the past three years are the most justifiable fruit of the high speed research aircraft program begun 12 years ago under the joint sponsorship of the Air Force, Navy and the National Advisory Committee for Aeronautics and skillfully overseen by a quartet of aeronautic administrators, two program managers of rocket power and a score of military and civilian test pilots.

At a time when the value of various types of aeronautical research methods are being sharply questioned by "Johnson-esque" critics in the scientific and military field, it might be wise to look at the records of the past high speed aircraft research program over the past decade. It was a costly program both in dollars [probably close to \$100 million] and in lives. Four pilots lost their lives in the research aircraft series—Howard Mills of NACA, Jim Zugler of Bell Aircraft Corp., and two USAF pilots from the Flight Test Center at Edwards AFB, Capt. Milburn Apt and Maj. Raymond A. Poppe.

The research aircraft program was originally conceived in 1943 by Gen. Henry H. Arnold when he was chief of the Army Air Forces in World War II and Dr. George W. Lewis then director of NACA who at that early date were already envisioning the attainment of supersonic flight in the next decade.

By the end of the war in 1945, it had established only a firm program that was to study the basic tendencies of the supersonic era of piloted flight.

The complete list of people who made major contributions to this program during the subsequent 10 years is too long for mention here. Among its leaders, however, were:

In the early phase, John Stueck of NACA who also supplemented the flight program with the development of the transonic wind tunnel; Hans Kuehner of Wright Field, Tom Tyne and E. W. Conder of the Navy Bureau of Aeronautics, the Bell Aircraft Corp. team of Larry Bell and Bob Woods, and the Douglas engineering effort spearheaded at El Segundo by Ed Heinemann and at Santa Monica by Ed Burton.

In the rocket power developments that began to prove decisive in pushing the research aircraft all the way to Mach 3, the work of Jim White of Reaction Motors Inc. on regenerative cooling and the Curtis-Wright group that developed the first practical rocket thrustline controls was vital. Other key areas included Carl Keachert chief of the aircraft laboratory at Wright Air

Development Center and Bob Stealey, then with Bell, who developed the nuclear plane drop technique that contributed so much to the useful high speed data yielding most of the hottest research results. The work of Maj. Gen. Al Boyd and Brig. Gen. Stan Holstrom, who were the successive commanders of the USAF Flight Test Center at Edwards AFB, and Walt Williams, who headed the NASA flight section at Edwards, also provided a sound foundation for the program operations. Among the pilots who contributed as much to extending the frontier of piloted flight were Chuck Yeager, Pete Everett, Scott Crossfield, Joe Walker, Herbert Hoover, Kit Morris, Bill Brightwell, Irvin Kershner and others.

Finally about 15 months are included in the program including those not originally planned for that work, such as a specially contrived B-47 operated by NACA to investigate high speed load problems and wing distortion, and the Convair XFY-1A that was modified successfully in pioneering the delta wing design now proved out in the F-102 and F-106 as another supersonic interceptor, and the B-58 supersonic bomber. The Bell X-1 series and the Douglas D-558-II proved to be the work horses of the specially designed research types. The X-1 was the first aircraft in the world to reach the speed of sound, the Skyrocket was the first to test Mach 2 and the X-1A was the first to test Mach 3.

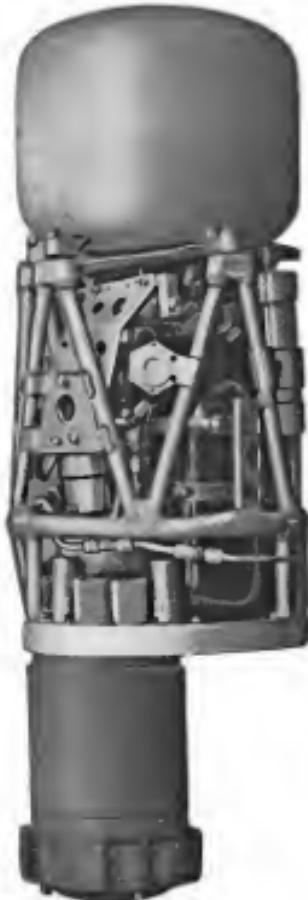
The X-2 recently completed the current phase of the program by reaching Mach 3 before going out of control and crashing. Less spectacular, but equally productive, were the Bell X-5 with variable sweep wing that exploded the 40 degree sweepback idea, the Northrop X-4 that tackled stability and control problems of tailless aircraft in the low transonic stage and the Douglas X-3 that provided extremely valuable data on the new problem of metal coupling.

Another important feature of this program was the speed with which data obtained from the high speed flights was fed back into the industry design and engineering systems. From the first supersonic flight of the Bell X-1 at 70,000 ft. in 1947 to the first flight of the first truly supersonic operational fighter—the North American F-105—in 1953 was only six years. Today, fighters can掠assure at the 70,000 ft. altitude that the X-1 basis touched in a maximum climb.

The last final flight of the Bell X-2 that hit a maximum speed of 2,175 mph brought to a close the high speed research aircraft programs if it was originally conceived. There is no doubt that the program was a major factor in extending the frontier of piloted flight into the range of space at 126,000 ft. altitude and out to faster than the speed of sound. A new phase of the program is should under way embodied in the North American X-15 designed to carry men at speeds of Mach 5.

As long as this country has the courage to invest steadily in long range aeronautical research, the industry, engineers and pilots will accept the challenge and run the risks that are necessary to keep an economy in the air and put it out into space, too, if required.

—Robert State



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WHO'S WHERE

In the Front Office

J. A. Skupin, operations vice president of the company, a division, Thompson Products, Inc., Cleveland, Ohio. Also Wm. C. Ritter, a new president.

Holton P. Farnsworth, recently designated Tepp Manufacturing Co., a Division of Tepp Industries, Inc., Berry Hill, Calif.

Howard C. Clapp, president, George L. Mackay Corp., Inc., 50th & Mc Cleary Avenue, George E. Naderowicz, director, who located the company.

Malvin J. Miller, president, The After Manufacturing Co., Hartland, Conn. Also Edward S. Goss, vice president/technical director.

R. K. Hadley and C. D. Rivers, vice presidents, from Fairchild Manufacturing Co., Piermont, Ore.

Norman C. Anderson, vice president, Phenomenal Transistor Division, Electronics Corporation of America, Cambridge, Mass.

Robert D. Gray, vice president, Peavey Instrument Company, Inc., Great Neck, N.Y.

Lee Synderup, vice president, General Sales and Robert L. Thomas, vice president, traffic, Air Transport Association of America, Washington, D. C.

Henry J. Freudenreich, controller, Fairchild Aircraft Company, Inc., West Hingham, Mass.

John J. Clark, chief assistant to the manager of Aerospace Division, Convair, a Division of General Dynamics Corp., San Diego, Calif.

Merlyn Melvin, corporate assistant to the president, Coffey Industries, Inc., Menlo Park, Calif.

Geno J. Schmitz, Washington, D. C., director manager, Silver Spring, Md., Aviation Division, Walter Kidde & Company, Inc., Silverville, N. J.

Honors and Elections

D. Ernest Baldwin, formerly with the Naval Research Laboratory and now chief scientist of Aerospace Instrument Laboratories, Inc., received the Department of the Navy's Meritorious Civilian Service Award, the second highest merit award given to civilian employees in recognition of his major contributions to the Laboratory's programs and to the field of electronics.

Changes

L. F. Van Der Weel, chief engineer, Ghidels Rocket Products Corp., Glendale, Calif.

George J. Castello, manager, Oklahoma Facility, Defense Dept. W. & M. Corp., New York, N. Y.

Robert C. Bryan, assistant general manager, Defense Research Associates, a Division of Universal Match Corp., Ferguson, Mo.

Capt. Rinaldo M. Brubaker, manager, Govt. Relations Committee, American Airlines International, New York, N. Y.

INDUSTRY OBSERVER

►**Marshall** for Climax Vaughn's FRU 3, an improved version of Navy's FRU 1, is now being produced. The aircraft, which will be substantially faster and larger than the FRU 1, will be powered by Pratt & Whitney's J53-turbjet engine (AVW April 1, p. 25). FRU 3 is still in use and one fell in two years away from flight status.

►**Pratt & Whitney** will combat weight and corrosion problems in one version of its J53 turbojet engine through the incorporation of substantial amounts of titanium alloy at applications similar to those used in the company's J57.

►**Chance Wright Aircraft** will evaluate possibility of protecting the aircraft aluminum of future fighters with a series of platings in order to withstand temperatures of up to 700 degrees.

►**Lockheed Aircraft** may use the Wright-Lewis J34 turbojet engine as an auxiliary powerplant for the WZV-1, new version of the Constellation radar plane being built for the Navy.

►U.S. Army Aviation is assessing increasing lift/thrust from aircraft main rotor blade pitch control servos used as collective pitch for the Navy and USAF. Present, including North America, Grumman, Northrop and Douglas, are making an effort to meet Army requirements despite the service's determination to hold down development costs and keep heavily off-the-shelf main rotor blades if possible.

►Appropriately 35% of the exterior surface of Northrop Aircraft Inc.'s supersonic V35 trainer will be precision-welded channel welding flat panels of external material.

►Gillies of Naval Research has received six gold-plated magnesium spheres for Project Vanguard from Strohla and Franks, Inc., of Detroit. Paint coating on the spheres are being applied by Army Corps of Engineers aviators and development laboratories at Ft. Belvoir, Va. Paint coatings go on the gold spheres—in addition to chrome plating, a separating layer of silicon monoxide—and a layer of highly reflecting aluminum and a final layer of silicon monoxide. Silicon monoxide sheets extend over and under heat to protect the aluminum.

►Final design studies for Army's flying crane are being deferred for evaluation. Apparently no contractor is taking part in the competition. Army's Transportation Corps will study the results, then report what is available at what price. Effort is being made to avoid waste of money and engineering talent on projects with little promise.

►Hippisch-Siemens' BL04 line thrust liquid oxygen engine has completed its 150 hr. endurance tests. The new engine, a derivative of the earlier BL00 which delivered a base design thrust of 2,640 lb., has a thrust of over 3,000 lb. without afterburner. The engine, an axial flow type with seven compression stages and one turbine stage, is designed for use in lightweight fighter aircraft.

►Russian scientists are taking a hard look at oxidizer propellants as it applies to medium rocket flight. One recent book, "Manned Problems of Interplanetary Travel," is a collection of theoretical and experimental data compiled by doctors outside the USSR with comparisons by Russian medical authorities. American rocket experiments with nitrates and malonates are cited.

►Experiments related to the space travel regime have established the limits of casting and casting during a condition of weightlessness. The studies, conducted at the School of Astronaut Medicine, Randolph AFB, Tex., employed a Lockheed F9C following a possible flight path that attained intervals of weightlessness as high as 45 sec.

►French air force will place a set of Hawker-Vanguards in radio-controlled target drones. First radio-controlled Vanguards recently flew from the air force test center at Bourges.

BEYOND THE POINT OF NO RETURN?



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of this equipment will soon be installed in Air Force B-57's, C-133's, C-137's, and KC-135's, as well as other new military and commercial aircraft.

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Washington Roundup

Twinning: Research Confined

USAF Gen'l Staff Gen'l Nathan F. Twining sees the Air Force in "defending or deterring" its primary research and development projects with additional "potent fiscal power" because of budget cutbacks.

"String research costs, stemming from bad coupled with mounting complacency, lead to costly cutbacks and development to a minimum level," Gen'l Twining told the Senate Armed Services Committee last week. "In contrast, the Soviets appear to be pushing their research and development across a front which they have made considerable advances just recently."

Gen'l Twining soon to become chairman of the Joint Chiefs warned the committee that to achieve striking forces the Air Force is "considerably stronger than the Soviets," and that our relative position has improved over the past year because of two factors—increased B-52 production and a downgrading of intelligence estimates of Soviet capability. "Our intelligence estimates," he said, "of recent and future Soviet strength changes have been to rise in our confidence to get better intelligence."

Gen'l Twining stressed USAF's capability to "bounce" and "roll back" and predicted the need to dislodge the present "line of total defense" because it would no longer suffice. Here's his assessment of the relative capabilities of U.S. and Soviet airpower:

- Medium jet bombers: "We continue to estimate the Soviets to be a wide margin. Current estimates indicate that we will keep the lead, but that it will diminish as the B-52 mission jet bombers come into the Soviet inventory."

- Light tactical bombers, day fighters and fighter-bombers: "Here the Soviets have held and will continue to hold a very good (survival) advantage."

- All weather interceptors: "We are well ahead in routine type both to date and in the future."

- Transport aircraft: "The U.S. remains well and will remain a big operational lead. However, from the standpoint of transport aircraft performance, we must remember that the Soviet Union is the only nation now operating jet transports over scheduled routes."

Hector Joins CAB

John J. Hester, Jr., past president Florida lawyer, was sworn in last week as a member of the Civil Aeronautics Board. Following his unanimous confirmation by the Senate Aeronautics Committee, Mr. Hester left by Joseph Adams where transportation secretary James C. Edwards and the five members of the Board agreed to his retirement. A former law firm partner since 1946, Hester was formerly Assistant Undersecretary of State, Assistant Lead-Law Advisor, tutor and a member of the Office of Strategic Counsel, Department of Justice. He was educated at Harvard and Williams College, earned his LL.B. at Yale Law School and studied at Oxford College, England.

Symington Pushes Economy

Sen. Stuart Symington (D-Mo.) is in the forefront of a congressional economy drive whose leaders maintain that "not much" could be cut from the administration's \$15 billion defense budget for Fiscal 1955 if there were no adequate stopgap measures.

Sen. Symington told the Senate that "for his world will go back unless it starts building its defenses on the

basis of programs instead of tradition." The budget, he said, contains repeats for just sorts of money which involve unnecessary duplication, and even duplication, along with the regular expense. In fact, as we now know, is expected to appear some substantial portions of which are predetermined as such.

"The private reason for this is that conditions in the continuing funds, on the part of the executive branch, do not have to defend that country in case it is ever attacked."

Last year, Symington was a key spokesman of the Democratic party in efforts to add \$500 million to USAF's budget. His approach, however, for cutting this year at the budget requests of the other two services, although it has received widespread support, Democratic opponents proposed to increase funds for the Marine Corps and the Army.

Congressional Outlook

Look for the Senate Conservative Action Subcommittee to give its approval to legislation granting permanent certification to established firms as certified. Armor, Flying Tiger, Buddle and AMICO Inc. Despite a non-consensual attitude taken by the Civil Aeronautics Board in turnback last week in the support of the measure, from Sen. Mike Mansfield (D-Mt.), conservative chairman, Sen. Andre Birotte (D-La.) and Sen. George Smathers (D-Fla.).

Other congressional developments included:

- Legislation that would establish an Office of Civil Aviation Medicine headed by a Civil Air Surgeon under the authority of the Civil Aeronautics Administration was opposed by both the CAB and CAB supporters from Dr. Herbert Frosner, president of the Civil Aviation Medical Assoc., in testimony before the Senate Conservative Action Subcommittee.

- Registration authorities rebuffed efforts to set aside money from equipment fees for new equipment. This was introduced by Sen. Wayne Magruder (D-Wash.) chairman of the Senate Conservative Committee, and Rep. Otto Harris (D-Ala.), chairman of House Conservative Committee.

Airways Equipment Plan

Civil Aeronautics Administration is asking for \$610 million to purchase aircraft equipment during the next six years as a result of the adoption of Vortax in a Commerce Service. Cost of operation of the new system beginning in 1952 is estimated at \$150 million annually—an amount that will be covered in part by user charges on military, commercial and private operators. As originally drawn up, it is planned that all charges would be based on a flat fee and a self-limiting surcharge. The CAB is also asking for a supplemental appropriation of \$15 million to its 1957 budget to cover immediate costs of implementing the Vortax system.

Original estimate for aircraft implementation between 1957 and 1961 had been set at \$250 million, but the introduction of Vortax alone is expected to cost \$25, 460,000 plus \$35,316,000 for ILS TAC units. The total of \$114 million will give the U.S. complete coverage by 1965 with 1,239 Vortax and 289 ILS TAC stations. The latest revised estimates were revealed in the science bill last week of the House Appropriations Subcommittee.

—Washington staff

Curtis Will Urge New Aviation Agency

Clear statutory authority to develop and evaluate traffic control solutions will be sought for new group.

By Philip Kline

Washington—Speedy formation of a national aviation traffic agency to research, develop and evaluate traffic control problems will be recommended this week by Edward P. Curtis, special assistant to the President for aviation logistics planning.

The recommendations will be made in an interim report, the first as the Curtis group's one long study. It is expected to lead eventually to a comprehensive recommendation. Curtis will make his complete report to the President early in May.

Combined Duties

The proposed agency would assume most of the responsibilities now shared by a broad range of agencies, including the Civil Aeronautics Administration, Air Conditioning Contractors, Air Navigation Development Board, Radio Tech and Council Committees for Aeronautics and the three air forces.

To avoid the interagency strife long plagued the ANTRAC, Curtis will urge that the new agency's responsibilities be clearly defined by statute. Further, he will propose that it be given its own funds for contractual purposes and not be dependent upon the grants of other government agencies.

Curtis also will recommend that the new agency include a major experience review section where all relevant requirements, technical and operational decisions can be immediately evaluated under realistic operating conditions. Curtis has suggested the temporary use of CAA's Technical Development Center in Indianapolis or the Air Force Cambridge Research Center facilities at Ft. Detrick, Md., for this. However, he is expected to recommend a large, more mobile flight evaluation facility for permanent operations.

Recommending the efficiency of creating an experience review section, Curtis personnel to staff the new agency with present civil service salary levels, he said, and perhaps 50 to 100 aircraft. This estimate is based on a paper by Lloyd J. Perper, a member of Curtis's Flight Evaluation

The flight evaluation facility which Curtis is expected to recommend will require a major aerial, research satellite facility, and perhaps 50 to 100 aircraft. This estimate is based on a paper by Lloyd J. Perper, a member of Curtis's Flight Evaluation

Postage of an adequate military warning device could be ready within one year, Brig Gen Joseph D. Coffey, director of USAF Flight Safety Research, and of the R&D committee meeting in New York.

Related developments, he said, had been to design with the idea that such a device is beyond the present capability of existing systems. Minimum Air Force requirements are to give the pilot the position, course, and speed of any other aircraft in his vicinity.

ments Laboratories and other groups. • **Contractor-specific analysis, acquisition, development or evaluation programs to industry.**

Brief speech by Curtis, James L. Austin has written placing Curtis, and other members of his staff, in a very difficult position. Speaking at the recent Institute of the Aerospace Sciences meeting in New York, Curtis and others were so "usage friendly" which could solve current traffic control problems completely.

The solution, Curtis said, requires a "reformed development organization" backed by the best talent in government and industry, organized to work continuously to solve ever changing problems. The only mechanism we have today is a complicated maze of committee work which endeavor to resolve conflicts at their source."

Speaking at the recent Air Line Pilots Association meeting in Chicago, Austin cited Curtis' "high level of authority, composed of brilliant scientists, engineers and operational experts" and "solid and enduring personnel" to replace today's "part-time, consultation and board." This, Austin said, would make it possible for Committee system change studies and litigations to be determined from scientific and experimental data instead of being decided by "old timers, tactics and arbitrary voting."

Flight Evaluation

The flight evaluation facility which Curtis is expected to recommend will require a major aerial, research satellite facility, and perhaps 50 to 100 aircraft. This estimate is based on a paper by Lloyd J. Perper, a member of Curtis's Flight Evaluation

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Another challenging area for the aviation industry is the design of low cost instruments which would enable pilots without full IFR proficiency to handle separation—elimination of checks on positive separation norms.

In the report to the President, Curtis will point out that present day objectives in automation concern both the pro-



cessing function can do much to improve traffic control capabilities and will recommend a major effort to apply these techniques.

Curtis also recommended development of a mobile data link, or "traffic control reporting system (ATCRBS), to relieve present congestion.

Curtis is not expected to recommend any drastic changes in the basic Cessna Skymaster as the basic Cessna 172. He would still not attempt to spell out the precise requirements for 1973. This will be the task of the new agency which Curtis proposes.

Japan Will Decide Between F-104, F-100

Tokyo—Japan Defense Agency will shortly decide whether Japan should buy two USAF contract aircraft, the F-105 or the F-104 intercepter jet fighters. At present, it is not clear which of the two planes would be best suited to the country's defense needs.

Kurewada Aircraft has filed with the Japanese government plans for production of the F-104. The firm has received a license from Lockheed Aircraft. Kurewada currently is negotiating with the firm North American Aviation. North American has submitted to the agency plan to convert F-100 into an all-weather fighter.

Ion Rocket for Space Exploration Proposed at Rocket Society Meet

Washington—Rockwell International Corp here last week said it is one of two USAF contractors studying the feasibility of ion propulsion for missile systems (AW Feb 19 p 17).

The Rockwell engineers also came forward with a proposal for a nuclear-powered ion rocket capable of sailing lights to make scientific observations of solar system bodies.

In a session presented at the annual spring meeting of the American Rocket Society, Martin I. Willhakis and E. G. Orr, of Rockwell, suggested a 3,300 lb. vehicle, which they have designated the Stinger, that would be an unmanned satellite—a solar-hauled sail to the sky by a booster rocket similar to the type designed for the aerospace research ballistic missile.

Rockwell has filed with the Japanese government plans for production of the F-104. The firm has received a license from Lockheed Aircraft. Kurewada currently is negotiating with the firm North American Aviation. North American has submitted to the agency plan to convert F-100 into an all-weather fighter.

In addition, the electric engine would separate the data collecting and science instruments during the entire xenon propellant flight.

The two engines use Stinger is entirely feasible in terms of current technology and holds several advantages over more ordinary and conventional propulsive systems for space flight based on mainstage chemical rockets.

In an informal announcement of an Air Force contract, Rockwell is more cautious. The company makes no specific claims for its project as it remains the possibility of ion propulsion itself.

Rockwell says the problem of getting thrust from high velocity charged particles will not produce the power needed by chemical rocket propulsion systems. For this reason the application appears confined to the very high altitudes, where the engine develops a low thrust of pounds of force, eight accelerate a weight weighing thousands of pounds to good speed. Full acceleration would be less than

Configuration of the proposed



Vanguard Gantry

Full size of the gantry, built to handle the three-stage Vanguard satellite vehicle, shown & being used Viking test vehicle (left). Viking is being tested for static loading and launching on Vanguard's launching platform. Gantry is outside, rolling on water-ski-like rails to launching site to help protect the mobiles, then locking every joint to a launching. Viking and Vanguard on route to the Glenn L. Martin Co., Baltimore. The static test and launching platform and the gantry were designed, built and located by the Army Hydrogen Division, Baldwin-Lima-Hamilton Corp., New York.

satellite vehicle, which represents only one of several possible applications if no propulsion is present, is highly unusual.

Patched section of the vehicle will be separated from the part containing the nuclear powerplant by telescoping rods to protect the guidance system and instruments from the effects of rotation.

Patched in at a cost of \$1,500. It, gross weight at 3,700 lb. The saturated gas pressure is 100 psi, and vacuum up to 10⁻⁶ lb. The next known development will be the orbiter at 250 lb.

Sodium Content

The orbiter will have a sodium coolant, and its design clearly uses one of the major problems encountered by Williams and Grier. During the early part of the program, the orbiter was pulled by a two-stage rocket. The orbiter will be wrapped around the vehicle and the nuclear reactor sodium telescope to form a compact assembly.

One booster in its orbital elliptical orbit will be dropped, and the orbiter unstrapped at a later point in its voyage. At the same time, the ion propulsion system will be extended activated, and the vehicle will continue to go around until it is in the orbit of one of the planets.

Vanguard's designers are, however, on rocket motion during their studies

so far as launching points on the earth are concerned, along with trying to optimize the transfer orbits for sending data back to the earth. The sun-synchronous orbit can be rotated to dissociate ionosphere without changing the attitude of the vehicle in space.

Patches of the orbiter will include television, radio, communications equipment and nucleus power station. Both biological and electronic systems will be used to reduce atmospheric currents and temperature differences.

Two small patches each year are planned to increase the number of satellites of plasma. The results can be recorded on tape, video and telem-

SUPersonic TEST SLEDS

Increasing importance of supersonic rocket sleds in research has forced a road toward liquid propellants—especially for programs requiring a high rate of rise, rate of fire, long duration of runs, ease of launching, constant velocity.

Reaction Motors, Inc., has a contract to design two large liquid propellant rocket sleds to propel test sleds at the Air Force Flight Test Center, Edwards AFB, Calif.

Aerospace General Corp. has designed and completed two liquid sleds intended for the Supersonic Naval Ordnance Research Task (SNORT) at the Naval Ordnance Test Station, China Lake, Calif. It now is building the rocket engine and turbogear for a

British Slug

London—After Aérospatiale U.S. Chief of Naval Operations, Admiral during his visit to Britain had a look at British surface-to-air guided missile called "Sea Slug."

This missile has never been tested or acknowledged by the Ministry of Supply or British Admiralty Board and the U.S. Navy had been "misleading" reports.

It is believed to be the missile being tested at RAE Farnborough, the British guided missile trials shop, and planned for use in the new fleet destroyers.

third sled to be used by Colgate Engineering Co. in its Research and Development Command's Separation Military Air Research Task (SMART) at Edwards, Calif., Ortho.

C. E. K. Smith and H. M. Pollock of Aeroflex sold the American Rocket Society that the spokesman of liquid propellent in "a well-established" concept, but it is relatively new operationally. The two SNORT liquid sleds, the AJ10-15 and the AJ10-16, have undergone 65 static tests and 16 dynamic tests.

Their design requirements, although not disclosed, call for three stages: 180-1,000 lb payload, 10 sec G acceleration, 2,000 ft per second velocity, 88,160 lb dynamic pressure, 10 sec G deceleration, zero temperature range plus one more.

• Vertical checklist. The vehicle is erected and spined in a fixture capable of holding two vehicles at once. Dolly slides allow erection without causing loads being imposed on the model. Guide and pointers are attached to the guided power plants as a final checklist of the control system can be made. The model test engine is spun over.

• Transport and recheck. The vehicle is shipped to Paris, and after a complete inspection, horizontal tests performed at a larger windup to the program.

• Static firing of second stage. Many components of the launching system are checked by vibration and other methods. The second stage is supported by hydraulic power supply on support structure, which houses the different solid propellant stages, dumper plate, which supports the cabin and other components in the second stage. Two firing stands, supplied by Foster Hydrostatic Divisions of Baldwin-Lima-Hamilton Corp. (previous p. 25) can be mounted on the support structure for static firing of the second-stage engine, one for static and flight firing of the first-stage engine.

The Baldwin-Lima-Hamilton firm makes with roughly the same units used in the horizontal checklist of Merlin. The Baldwin-Lima contains a Federal Electronics power supply and a Baldwin-Lima-Hamilton weight indicator. Details on p. 96. Second stage is tested after position on its dolly and erected as an eight-ton capacity, 10,000-lb static engine originally built by the Davidoff Co. for the Navy Bureau of Ships. The second stage is supported by Foster Hydrostatic Divisions of Baldwin-Lima-Hamilton Corp. (previous p. 25) can be mounted on the support structure for static firing of the second-stage engine, one for static and flight firing of the first-stage engine.

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After the second stage is fitted to its firing stand, static firing units and air and oxygen and dry-docked hydraulics are supplied from special tanks. High-pressure helium is supplied from an auxiliary tank; the oxygen tank, carbon dioxide and water fog nozzle system have been installed on the support structure, and decompression thorium has been applied.

• Static firing, first stage. After static firing of the second stage, the first and second stages and the same one-made of a modified flexible phenolic material with a fibrous epoxy resin—supplied. First stage is attached to the firing stand by a witness joint which detaches during the thermal cycling period. This requires structural weight in the rocket body to withstand the large stresses. Liquid oxygen can be supplied to the support structure for launching purposes by the standard transport vehicles, but, in the event of loss of line by fire or cold-flow resonance, the supply can be brought up to the nozzle of launchers via insulation tools in the lox system at the launch site. Hydraulics provide a lift for the vehicle with a specially-designed pump line specifically-designed, mounting fixtures.

• Flight. After static firing, complex return checklist and instrumentation tools are performed. Now the vehicle must be aligned with the virtual or witness materials of a sled. Guide sticks attached to the vehicle and optical equipment supplied by Kordel and Keen Co. are used. The liquid-propellant third stage—which is bolted and bolted in a manner—a small test stand and dolly, using special dogs to eliminate the need for a separate sled, is used. The liquid-propellant and separation motors are also the modified. Alignment of the third stage with the second stage gives reference to "very critical." Williams said since the third stage has no control option and depends on quantification. Alignment is done with an optical leveling device. Next sled assemblies are prepared for the auxiliary jets that will control the second stage in roll, pitch and yaw during its coasting phase. The vehicle will be ready for cooldown and fueling.

Williams insisted consisting of instrumentation and equipment on the vehicle, "since these systems are not an integral part of the launching vehicle and will vary."

Vanguard—From Assembly to Firing

Washington—Site of the complex support equipment required for Vanguard firing was given last week by Gen. William Glavin, L. Marston Grier, Vanguard product design project supervisor, in a paper presented to the American Rocket Society's spring meeting. Here is a summary of what happens to a typical Vanguard rocket from assembly at the Michelin plant in its hangar at French Air Force Base, Fléac.

• Element checklist. When construction is complete, first and second stages are placed on a chassis, centered under dolly heavy enough so that second during transportation will support minimum loads on the model. A options checklist is made, using a modern test console designed and manufactured by Federal Electronics Corp., with a Minneapolis-Honeywell gyro manager panel and Marconi receiver panel. Systems of electrical, hydraulic and pneumatic (helium) power plus one motor.

• Vertical checklist. The vehicle is erected and spined in a fixture capable of holding two vehicles at once. Dolly slides allow erection without causing loads being imposed on the model. Guide and pointers are attached to the guided power plants as a final checklist of the control system can be made. The model test engine is spun over.

• Transport and recheck. The vehicle is shipped to Paris, and after a complete inspection, horizontal tests performed at a larger windup to the program.

• Static firing of second stage. Many components of the launching system are checked by vibration and other methods. The second stage is supported by hydraulic power supply on support structure, which houses the different solid propellant stages, dumper plate, which supports the cabin and other components in the second stage. Two firing stands, supplied by Foster Hydrostatic Divisions of Baldwin-Lima-Hamilton Corp. (previous p. 25) can be mounted on the support structure for static firing of the second-stage engine, one for static and flight firing of the first-stage engine.

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mentally without a corresponding increase in expense, Sager said.

A velocity of 8,915 ft/sec, an optimum entry Mach 3.5, has been selected for the 1,500 ft terminal ballistic track at AFM's Abacoa Proving Ground by using two three-sec solid rocket boosters for the first stage and one for the second, according to Marshall E. Bousfield of Abacoa. Only the first stage was used in the first stage.

Consideration is being given to lengthening the first stage to obtain higher velocities. The task is now under way to evaluate rocket workload and fuel loading, but it has been used to some extent for fire flight, as shown you, impingement, penetration and deflection studies.

PROJECT VANGUARD

Initial estimate of the Vanguard satellite and its inertial orientation system will be made by April 15, and final weight will be plotted with 30,000 in gold, according to Robert G. Bourassa of the Naval Research Laboratory.

Inertial instruments will facilitate handling, reduce expense and give a low radiation heat transfer from the shell to the internal package.

The five ratings for the outer surface of the 30 in magnesium sphere will be gold, aluminum, vacuum encapsu-

LeMay Is Vice Chief

Washington—Gen Curtis E. LeMay was officially named USAF Vice Chief of Staff last week as acting assistant chief of staff for the Air Force Materiel Command. Col. George W. Twining, who replaced Gen. Thomas D. White when he became USAF Chief of Staff (AW April 1, p. 39), Gen. Twining is taking over as chairman of the Joint Chiefs of Staff.

Initial work on the gold plate, aluminum core, titanium, and a dual outer coating of silicon monoxide that will give desired thermal emissivity.

In discussing design, fabrication and testing at the American Rocket Society meeting, Bourassa and management "seem to stand out at the center of the scene among their colleagues," a memorandum of the meeting reported. Bourassa can operate only in a non-porous carbon temperature range.

To withstand severe vibrations, shock and temperature conditions, electronic components will be supported by using a film of plastic coating compound.

F. Condie Shultz, Vanguard group engineer at the Glenn L. Martin Co., and several hydrazine propellant

jets will provide self control in the first stage of the article launching vehicle.

Propellant jets will control attitude during assembly and separation. Eight jets fed by residual gas in the helium propellant pressurization tank will can fuel, pitch and yaw during second stage starting flight. Second-stage casting is very critical because the third stage has no guidance, and an error in established by the position of the second stage it would lead to failure.

Hydrazine propellant, decomposed into high temperature nitrous, drives the turbine that powers both the first stage propellant pump and the hydrazine pump which furnishes power to gimbal the first stage thrust chamber.

The turbines then exhaust through two nozzles, which are turned clockwise or counterclockwise in less than 1/10 sec to overcome cold start difficulties required to get the liquid to accelerate and disintegrate or rating parts such as the pyrodetes turbine.

The turbines are revolved in a series of plow and luff a thrust of approximately 10 lb. Thrust rating is obtained with solenoid controlled pneumatic actuators, using gas from the helium system.

It is to spend special designs. "But it will pay dividends" to utilize standardized components because of simplified manufacture and support that result," he said.

• Engineers follow up until the weapon system has been fully proven for operational use. This means until the system has been tested and the development of the system has been completed. Miss production appears in the section, is introduced into operational units and after it has passed the initial tests when engineers generally pull out of the chain of responsibility. "Less than complete engineering of these corrections, modifications and alterations," he said, "will result in an unsatisfactory weapon."

Cost \$1 Billion

Engineering changes cost the Air Force \$1 billion per year, asserted Gen. Lewis, listing that industry would be expected to keep cut fire costs.

• Development of new materials and new manufacturing approaches. It is not enough, he said to push "reappraisal" of existing materials above their normal operating limits, there, provide military coding as a catch. Industry must instead evaluate the existing materials capable of

withstanding sonic vibration and high temperatures expected in the new speed and altitude ranges.

• Minimum simplification of man interface. Minus engineers responsible for design should get on the ground before equipment arrives to see the environment in which the weapon system will operate. Engineers' observations also are the ones that can contribute substantially to the previous specification. One consequence of future effort is the gas turbine. Design of these should be such that insulation like heat sinks, compression, resonance sections and gear boxes are reusable for field repairs. Rotor blades, hub sections and engine assemblies should be individually replaceable.

Other developments reported at the meeting included production tools for standardized and homogeneous, a flyable turbine wheel and a report on pit impact test day conclusions.

AERIAL REFUELING

Progress in the design of the two, highly compatible aerial refueling aircraft—the flying boom and the probe-and-drogue—has reached the point where both can be considered the design of the year, according to Gen. Paul G. Schearer of Wright Air Development Center. He added that "both systems are considered to be at an equivalent stage of development and yet performing substantially from an operational standpoint."

Major areas of problems facing design are:

• Air speed/altitude compatibility.

• Other developments. A means of aircrew ejection developed for the drogue at air speed built up, though use of air bag certainly requires life.

• Constant drag design. WADC is currently studying a drogue design which would create approximately constant drag regardless of air speed variations within certain limits. This could mean some posture variation of the drogue with changes in speed. Additional advantage would be to narrow the load zone over which the drag must be taken.

• Fixed drogue. A boom or rigid drogue would be used to depress the hook when it exits from the tailbar to give greater vertical separation between drogue and plane. The idea is to be fire test evaluated soon. Variation of this concept is the use of two folding planes, one vertical, the second and horizontal, to pass fuel. The configuration has been tested flight

Mach 10 Manned Vehicles Are USAF Goal

New York—Manned air vehicles with speeds of Mach 10 are a U.S. Air Force goal within the next ten years. This contrasts with the immediate objective of Mach 5 for piloted aircraft.

Lt. Gen. C. S. Irwin cited these figures before the National Aerospace Meeting of the Society of Automotive Engineers in New York recently. "We have set our immediate sights on Mach 5 and speeds greater only conceivable for missiles."

"For missiles, the only performance limit is speed and range; priority is given to the use of resources and the need to keep costs within the limits of our economy."

Fasted in Numbers

One competitor has placed an in numbers and in class in on an in quality," Gen. Irwin, who represents Russian aerospace and assault industry last year with Gen. Nathan Twining (AW July 2, p. 26), warned. "It will take lots of action, dedicated and massive thinking ... to keep the review lead to new ways."

In an education-and-warning to the assault industry, Gen. Irwin stressed:

• Integration of engineering and design

• Engineering changes cost the Air Force \$1 billion per year, asserted Gen. Lewis, listing that industry would be expected to keep cut fire costs.

• Development of new materials and new manufacturing approaches. It is not enough, he said to push "reappraisal" of existing materials above their normal operating limits, there, provide military coding as a catch. Industry must instead evaluate the existing materials capable of



First RF-101A Will Chase B-52s

First production model of McDonnell RF-101A Voodoo ready on company ramp before delivery to Console for its chase plane for B-52 flights. Voodoo and Lockheed F-104 are only two Air Force fighters able to keep up with B-52, and top speed of B-52 is about that of F-104. Note at RF-101's wings (near F-104) to house photographic equipment. Gun access doors of F-104 are located at USAF design on leading behind cockpit, gun ports, just below U.S. lettering, are closed off on RF-101A. Two auxiliary fuel pods are under fuselage. Airplane can carry clusters of three at this position.

trating and has proved successful so far.

Other developments include:

• Colpax dry-gauge wheel tire system which is now standard.

• ML-2 nozzle drags which will include azimuth capability and a version which will operate in ambient temperatures of 100°F.

• Hydraulically driven hub units for propeller aircraft, an innovation the firm has been installing. Original units were electrohydraulic.

HIGH-SPEED TURBINE FAILURES

Succesful flyable-wheel high-speed turbine has been built and tested by the Aircraft Division, Turbine Dept., General Electric Co.

G.E. had the choice of two basic approaches to preventing damage from an operating failure:

• Automatically limiting speed of the wheel by closing the air inlet passage or automatically locking the wheel at maximum allowable speed. Both of these methods of protection should meet design problems because of the side operating range imposed on most turbines, which result in either weight increase, performance decrease or both.

• Containing turbine wheel within the turbine housing under all possible wheel burst conditions, either by restraining the turbine housing to withstand the burst at a high weight penalty, or by which would increase the required installed burst speed with the effect of the burst reflected by lowering payload size and weight.

Frangible Wheel

G.E. suggests about the frangible wheel approach. They designed an alloy steel hubless chord disc and hub to which very light thin-walled tube was attached to the star pitch. The pipe was designed to shear first and allow blades to spin at the desired burst speed.

Since burst speed was successfully controlled and weight of the blades reduced to a minimum, containment was easily simplified.

Containment of 100% of all burst fragments was achieved with no weight increase in the turbine's housing which has a wall thickness of only .041 in. Also no fair or other secondary housing was necessary for the burst load.

Frangible wheel design operating characteristics were: maximum rotational speed—49,000 rpm; burst speed—60,000 rpm; max operating temp.—730°F.; max inlet pressure—350 psig. Very high speed repeatable motion patterns (high duration of 1.1 millisecond) of a burst with lighting frequency of 12,000 per second) showed that the

wheel actually burst at 60,000 rpm.

STAINLESS HONEYCOMBS

Boron stainless steel is more favored than titanium, it will be more popular for future supersonic aircraft, according to Dugdale. All Folland Aircraft research personnel, Lockheed Aircraft Co. Staff, and will be used in very thin skins to offset its greater weight, stainless steel will probably be used in thicker skins, Folland said.

Despite the present high cost of boron fiber reinforced metal studies show favorable results (5100 lb/in per in. of fiber prior to infiltration), the need for this skin may be substantial against supersonic building will encourage a great deal of expansion in the art of manufacturing high temperature know-how, Folland maintains.

A general slowdown in the aircraft use of boron-reinforced panels is due to the panel infiltration cost of 40-80% of the cost of the part, according to Folland. Another limitation is that of bonding properties and quality control. This is often so marginal that cut-off of a batch of 15 panels, only 5 may be accepted.

One exhibit was an all-stainless steel tubular standard steel fastener panel by the Glenn L. Martin Co. All solid honeycombs have the dual advantages of better thermal resistance and thinner overall aircraft wing weight.

M. E. Riedel, North American

Aeronautics, indicated that new ultra

wide-wing methods will supplement traditional working.

Trend to very thin stainless steel skins will encourage more economic tools to aid in sheet metal rolling, L. G. Hall, supervisor, Engineering Dept., North American Aviation, said. Glass insulation has shown that it can handle sheet metal temperatures up to 1000°F. without damage, although difficult to obtain and the accuracy may not distract the part. North American has used it to keep skin temperatures down, reducing skin weight, scrap, and the cost of welding operations on such skins.

TURBOJET TRANSPORTS

Transonic tests upon the beginning aircraft have just completed, according to A. L. Lambard of Rolls-Royce. Instead, he said that is little performance in severe would usually decide which of the current transports wins a competitive bid.

Frank W. Kell, Aviation Analyst, Inc., agreed with Rolls-Royce that the two driving factors of transports used for certain transports would be low specific fuel consumption and reliability.

Kell described reliability in terms of a few possible removal rates, which

is far less to low maintenance costs.

To get worth in their usage, both sides claim, Rolls-Royce engine manufacturers ought to give airline managers guarantees that the maintenance costs of operating their engines will not exceed a reasonable maximum.

Fuel consumption and maintenance expenses account for more than

half

of the airline operating costs

Rolls pointed out.

HOT DAY THRUST

Tested thrust of a jet aircraft is not to 100% when temperature is 100°F. at sea level, according to D. W. Burns, Boeing Airplane Co. chief of preliminary design, Transport Division. The aircraft is 10% reduction in allowable takeoff weight at a specific field length.

A field length limited aircraft therefore can lose more than one-half of its design payload in long range operation if it is able to take off at sea level with a 10% payload, Burns said.

The performance losses are based on a 40 deg excess over the standard day temperature of 50°F. at a takeoff speed of 110 kt.

Resistance effects of elevated temperature operation for transonic jets are primarily due to the deterioration of maximum load carrying capability, Burns said.

At very altered temperatures or at ranges no more than two-thirds of normal, there is no significant operational problem.

For the most normal case, he said, in which the species density to provide flexibility in equipment for storage must in all parts of a large aircraft ship extending long range, as well as improved, direct, or omnidirectional navigation operation, the feasibility of providing solar power of three regeneration is evaluated.

The Boeing aircraft cited maximum engine and engine installed in maximum load down to new criteria of suspending for the high temperature losses.

Two methods of suspending an engine's thrust are by increasing engine speed for takeoff only, or by providing a winter operation system.

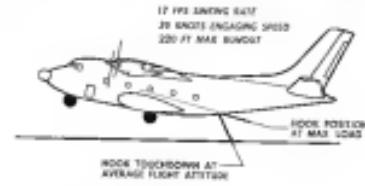
All three solutions must accommodate powerplants with different engine characteristics. Power is provided at where the base airplane would break even in a 100 passenger configuration with 47 passengers at 1,200 mi range, the overboard engine would require 51 passengers, the over-speed engine, 49 passengers, and the water augmented engine, 49 passengers.

Friley concluded that some means of increasing the ratio of takeoff thrust to all other thrust characteristics of the jet engine is needed, since engines used for cruise mission tend to be significantly unthrusty. By takeoff, passengers sit at above-normal temperatures



Douglas Turboprop for Fleet

Drawing and three-view of Douglas 196A, four engine turboprop proposed as a short range transport. It is similar to the Douglas 196A (WF Mfr. 23, p. 10), planned as a DC-8 replacement. Though the four engine has a nose reheat, overall landing length is 4 ft 4 in shorter than the transport version. On the long range performance is indicated in drawing below. Like a previous Finschel proposal, Douglas considers an aircraft capable of remaining a tank length at sea level, resulting in a range of 1,200 miles at 100,000 ft (WF Mfr. 1, p. 29). The Douglas airplane would use Lycoming T53 engines and would need modified high lift techniques in boundary layer control to maintain maneuverability. High engine thrust/takeoff ratio, high Bt. Rps., moderate wing loading, would give the airplane short takeoff capability. No wing or tail folding is used. Plans could be adapted with two engines out.





FRANCHE ALOUETTE II is Republic utility helicopter powered by a 360 hp. Turbomeca Astazou II. Republic is interested to build the ship.

Piasecki, Republic Take Options To Produce European Helicopters

Washington—Increasing U.S. interest in European helicopter designs was evidenced last week in discussions that two companies are considering manufacture of foreign-made rotary aircraft. ■ **Piasecki Aircraft Corp., Philadelphia, Pa.**, has an option to build the Ultra Light helicopter, a two-seat, top-speed 110 mph, designed by Fairey Aviation Co., Ltd., of England. ■ **Republic Aviation Corp., Farmingdale, N.Y.**, has been licensed to manufacture the French Alouette II, the place turbine-powered utility helicopter designed by Sud Aviation.

Both American companies are proceeding to demonstrate their new in-

terest in military customers, particularly the U.S. Army, which already has stated a requirement for assault of these types.

Fairey Ultra-Light

Fairey's Ultra-Light will be one of 2 half-size small helicopters to be considered by the Army, which will grant about 10 contracts for design studies in this field. First contract already has been awarded to Kaman Aircraft and other manufacturers will be asked to compete.

Because the Fairey design has advantages or simplicity that make it possible for the pilot to do his own

maintenance, the company says the Ultra-Light will have a total operating cost not more than half that of conventional small helicopters.

Mr. Guy Bondon H. Haussel, chief of Army Aviation, has not yet been able to procure enough of this type in large numbers for use by combat forces. Cost goal set by the general was approximately that of present models. The Ultra is tending to hold down design and operating costs on the project, and there is a possibility that it will have an off-the-shelf presence, in which case the Fairey-Piasecki design would be a candidate.

Alouette II

Republic Aviation's interest in the Alouette II also appears to be as effort to capitalize on a well-known existing design to meet an Army requirement. The French helicopter would be a candidate for Army's utility requirement, and could compete with the Bell XH-40, which is also a turbine-powered aircraft.

Republic also has interest in Navy requirements, where the Alouette II probably would be offered as an alternative to the new Kaman HU-21K1, for which a development contract has been awarded (AW Feb. 11, p. 34). Republic says the French aircraft is an efficient helicopter for anti-submarine work.

In the case of both the Piasecki and Republic aircraft, the basic design options can be built in the aircraft by Contractual Systems, which builds the frame from the French Technische En. The Alouette II is powered by a 360 hp Turbomeca Astazou III, the Ultra Light by the Fairey, a Turbomeca design.

RAF May Be Given More Flight Testing

London—Royal Air Force operational squadrons may take over more responsibility for testing new aircraft.

This has been decided in the House of Commons by the Secretary of State for Air. It was suggested to him that RAF flight testing might lead not only to better testing but also to fewer delays if the Ministry of Supply stage before the new aircraft become operational.

Agreeing with this, he said, is another step in this direction already has been taken, including such steps as stationing RAF liaison officers at aircraft plants, the Central Flying School, Farnborough, and the Royal Air Force Flying Schools.

Even when aircraft goes into operational service, he said, the intention is to try to fly 1,000 hours as quickly as possible and to send a periodical inspection.



FAIREY AVIATION CO. Ultra-Light is two-seat, top-speed helicopter powered by the Turbomeca Fairey. Piasecki has option.



This New 400 Cycle AC Rotary Actuator by

EEMCO

**Has an Operating Range of
320 to 400 Cycles ***

EEMCO Type 8422 400 cycle rotary actuator controls the trailing edge flap on the first red fighter supersonic fighter aircraft now in quantity production for the United States Air Force.

* One of the unusual features of Type 8422 is that it operates on a frequency range of 320 to 400 cycles whereas Military Specification requirements call for a range of 160 to 280 cycles for AC actuators and motors. The greater range eliminates need for a constant speed drive for the generator systems in the aircraft, which cuts down possible maintenance and at the same time reduces weight and cost.

A torque limiting clutch is incorporated in the motor in Type 8422 which disconnects the high inertia load imposed by the motor's armature. A brake can be built into this mechanism. Type 8422 is offered for use in some other capacity; another feature is the adjustable non-spring stops that are built into Type 8422 which is especially vital on an actuator like this load magnitude.

For the past 15 years EEMCO has made a specialty of designing and producing special AC and DC motors and linear and rotary actuators for the aircraft industry. Interest abroad has been in this field. Reflecting the high standards of precision gained from this experience is the fact that EEMCO motors and actuators are included in the armament of the latest jet aircraft and missiles now being produced for our national defense.

SPECIFICATIONS FOR TYPE 8422

Normal operating load: 20,000 inch-pounds

Maximum operating load: 32,000 inch-pounds

Ultimate static load: 70,000 inch-pounds

Range: 0 degrees to 45 degrees

Angular: 4 cycles or 25,000 inch-pounds of

400 cycles at 250 volts

Weight: 25 pounds

Deliveries: Type 8422 has been designed and developed to meet applicable military and aircraft manufacturer's specifications



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Douglas DC-8 Jetliners will fly an blue-ribbon route in the U.S. and overseas. Their transport is one of more than 40 types of turbine powered aircraft using Hamilton Standard equipment. Superior engineering, research, development, and experience lead toward Hamilton Standard's leadership in production of outstanding aircraft-jet or propeller driven.

Propellers • Motors • Air Conditioning Systems • Fuel Controls • Valves • Power
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Canadair CL-28 Makes First Flight

Canadair CL-28 military transport aircraft made first flight three days ahead of the schedule last down by engineers three years ago. With Wilkes Longford, Canadian chief test pilot, at the controls, the CL-28 lifted off the runway at 2,200 ft. in flight, which lasted 75 min. Second flight in test program was made the next day, with Longford and one crew of four aboard. Designated CP-107 by the Royal Canadian Air Force, the plane is a piston engine version of the British Bristol Canopus. Canopus will build 25 for RCAF, also plane a transport version with turboprop engines.

General Accounting Office Asks Tighter USAF Subcontract Policy

Washington—Central Accounting Office is calling for a closer USAF policy of oversight on subcontractors to firms more often than the House Armed Services Investigations Subcommittee headed by Rep. Edward H. (D-La.)

The recommendation comes from a GAO investigation of \$135.9 million in subcontracts awarded to Ford Douglas Fairchild, Inc., for B-57 wings by Boeing Aerospace Co., McDonnell Aircraft Co., Lockheed Aircraft Co. The uncomplicated profit after subcontractor was 9.4%. Under the actual expanded costs, there was a profit of 18.6%, or \$9.5 million more than unexpanded, according to L. J. Powers, director of GAO's Defense Accounting and Auditing Division. Powers and Ford made a voluntary commitment to refund \$1 million to USAF despite the fact that Boeing was reluctant to make a new recommitment of its contract. USAF paragraphs protected that test work, which, it said, "implies that the Air Force is not at a deficit in terms of a \$1 million voluntary refund related to the Ford Norden Co."

In a letter to Dibert, Secretary of the Air Force James Douglas and Ford were advised to make a refund on behalf informed that USAF considered its profits excessive.

Douglas said it was only after USAF "insisted" that Ford agreed to a \$1 million refund.

In the end, he said, a \$3.5 million refund was made to Boeing, Lockheed, and Douglas after calculation of a credit for true depreciation on fixtures due Ford was made from the \$3 million.

Powers claimed that the executive Ford paid "unjustified staffy because determination was made before soft

cost production experience and solid costs had been obtained and that closer control in the Air Materiel Command over prime subcontractors in this case would have resulted in a more equitable price."

He quoted AMC as saying that Ford's refund "will not only make up for the apparent error in negotiation but will provide an Air Force sharing in the resources due entirely to the efficiency." Powers added that USAF's "independence" "should not be held in the need for closer supervision by USAF of upgrade of major subcontractors."

"We do not suggest that USAF assume prime contractor responsibilities for executing certain programs," says Powers, but since USAF does have a direct interest, "we believe USAF should share itself" so the prime contractor fully protects the interests of the government."

Powers also urged that "significant economic price reduction gains be substituted to prime contractors."

Should be passed on to the government," he said.

On his part, Secretary Douglas told Rep. H. Robert that the refund agreement with Ford provides that "any increased profit" would accrue to an excess of the aircraft construction appraisal for sharing in cost reduction."

Lockheed will continue development of new high temperature steel for jet aircraft USAF research contractor for program, which includes a study of austenitic steels and of metallurgical properties of bearing steels for high temperature aircraft.

Aerospace Corp. and British firm of D. Napier & Son will exchange technical information on liquid fuel rocket engines, continuing an high test power plant.

Lockheed production pilot F. C. Fitter started from F-104A Starfighter star Edwards AFB last week, also the engine fired out.

Japanese Defense Agency first flight model missiles in stock, aimed at domestic production of U.S. Sparrow and Nike type missiles. In 1960 Japanese test missile, the TM89-98, has sped of Mach .4.

Lockheed C-130 Hercules took off at 11:10 AM B gross weight during tests of the landing gear system on March 20, 1961, at Edwards AFB, Calif. First SLIDE (new, bad and no development exercise) was engineered by Wright Air Development Center.

Glen L. Martin Co. set 56,011 lb gross load record for 48,000 sq ft plant at Gilmore Rd., where Locomotive made its production. First building of plant will include manufacturing, in grinding and administrative offices.

French carrier Dassault left France with 13 Dassault and 25 Mystere IV fighters for India. It was first Mystere IV delivered to India.

News Digest

Mile Safety Appliances Co. and Gulf Oil Corp. will undertake joint program in high energy fuels, which

AIR TRANSPORT

Decline in Overshoot Crashes Reported

Reversible propellers help trim runway crashes; near miss reports remain at dangerously high level.

By L. L. Doty

Washington—Slow decline in crashes caused by overshooting runways has resulted from the use of reversible propellers, increased pilot competence, and better training during flight. Major increases, however, remain a serious threat. An average of 1.7 new cases are reported daily.

A major informal but well-documented Civil Aeronautics Board study shows that 75% decline in the frequency of one overshoot per year million landings was recorded during the period between 1950 and 1955 from that of the 1945-1949 period.

In recent years, the number of overshoots increased again, indicating a change. Only two of the aircraft involved were equipped with reversible propellers and in neither case was the reversible mechanism found to be faulty.

Near-miss reports filed with the CAB between Sept. 1 and Dec. 31, 1958, were dangerously high, totaling 452 and constituting a total of 4,429 incidents around the flights involved.

No comparable statistics for previous years are available to indicate either a rise or fall in the number of collision cases.

However, the Board reported last year that 226 persons lost their lives in 127 aviation collisions between 1948 and 1957 (AVW July 30, p. 121). An additional 128 people were injured in the collisions of United and Trans-World Airlines over Grand Convair Jetline.

Non-Min. Analysis

Here are the facts brought out in the CAB analysis of the near-miss reports filed:

• Military flights accounted for 25% of the 542 near-miss reports filed, and flights for 73. Of the latter group, 83 were filed by untrained air carriers.

• Total of 40%, or 89% of the incidents occurred in controlled air space.

• VFR flights accounted for 54%, 76% of the cases, 72.7% of the incidents, and three double-deck jet liners.

• Majority of flights involved running paths, although 33% of the reports involved head-on collisions. Only 14% or 20% of the reports involved overriding approaches, which might indicate that this type of flight was initiated CAA's Technical Development Center

has found that the greatest danger of collision lies in overshooting because he cause of cockpit blind spots (AVW Nov. 5, p. 10).

• Analysis of the location of a near-miss collision was 50% between 1,000 ft. and 1,500 ft., 136 miles and between 200 and 300 ft. in 124 cases. This rate is exceeded in which the threat was first noticed within 300 ft.

Danger Zones

Most of the incidents occurred while aircraft were en route or en route to an airport at altitudes between 4,000 and 15,000 ft. Klaus points out that this was about 30,000 ft. when the threat appeared.

A total of 172 pilots reported a near miss or departure in arrival operations at airports with control towers. A total of 169 of these aircraft were flying below 1,000 ft. and of this group, 71 were flying within a speed range of 200 mph.

In 140 incidents reporting pilots did not observe the other aircraft before the danger of a near-miss was evident. In 78 cases, the pilot reported seeing the other aircraft prior to the danger of collision but did not feel a hazard existed until it sighted.

In 121 cases, the aircraft came to within 100 ft. of one another. In an other 282 instances, aircraft came to either 100 ft. or less.

Spectre Suspension

Washington—Civil Aeronautics Board last week denied a complaint requesting that Trans World Airlines Pilot Local 38 be suspended because April 1, the Civil Aeronautics Administration had issued a memorandum suspending United Airlines' suspension of Spectre as Title 14's allegedly dangerous while in flight without controller's authority (AVW March 16, p. 10).

The CAB also denied a complaint re-

specting that TWA be ordered out of one Spectre's routes as a pilot-only route.

The Board said it was convinced that Spectre will violate rules or make a way so that air commerce will be endangered. Spectre's future status will be determined at CAB review conference to be held later this year.

pilot was charged with landing too high in that, too far down the runway, with no time for a safe landing. The pilot was held responsible in six cases, and other personnel were charged with error in those instances.

Trans World was responsible for 10.

Near misses involving only pilot engine trouble accounted for 250 of the reports. In 70 cases, pilot engine and jet altitude were matched; jet jet was reported in three near collisions. Reporting pilots and they were unable to take evasive action in 313 cases, in 51 instances, pilots and evaders were too responsible.

Overshoot

The CAB report on overshoot landing accidents underscores the effectiveness of propeller pitch in controlling this type of crash.

In one of the two accidents in which propeller pitch was used, a pilot with reversible pitch propellers took off on a Lockheed 1049 and shortly thereafter was given a go-around because of the overshooting. The aircraft plowed through a boulder field and across a highway before it came to rest in an upward position. None of the 54 persons aboard were seriously injured.

In the other accident, the pilot was using a Boeing 737. Since neither of these aircraft propellers might have provided the necessary thrust, the Lockheed 1049 was made steeper and came down for reasons. Unable to decelerate the ground roll, the pilot made a right turn to gain speed, developed fear of passing air before reaching rate of climb limit, causing substantial damage to aircraft tail and substantial injuries to few of the passengers.

At touchdown, the pilot experienced a forward jolt when the thrust reverser was deployed. The aircraft continued to overshoot and eventually put the aircraft into a ground loop position. Brakes were ineffective.

Later investigation revealed that the current function of the propeller reversing system was in the "off" or inoperative position, prohibiting propeller reverse. Further tests indicated that the control buttons were pulled during a gear flight and were not reset prior to landing.

The 31 overshoot accidents included 11 DC-10, eight C-46s, seven DC-10, two L-49s and one B-57. All 450 overshoots were to the Boeing and Lockheed equipped with the reversible propellers.

Majority of the accidents occurred during winter months, and 23 took place during daylight hours. Return conditions were wet snow or snow-covered in 28 of the accidents.

A total of 21 flights were attributed to error of the controller.

pilot was charged with landing too high in that, too far down the runway, with no time for a safe landing. The pilot was held responsible in six cases, and other personnel were charged with error in those instances.

Trans World was responsible for 10. One accident, powerplant failure was the cause of three accidents. These include failure of checklist, front tire winter and bearing and propeller blade in flight.

Propeller Failure

Propeller failure in flight was the cause of one overshoot accident which might have been prevented by reversible propellers. A L-49 experienced a mid-function of engine number three and flew while chugging out of Los Angeles and both engines were feathered. Nevertheless, there was later insufficient fuel left to decelerate more than 1,800 mph.

An instrument approach was made at Los Angeles and the aircraft passed over the end of the runway and went into a tailspin. Brakes were ineffective on the slippery runway and without the aid of reversible propellers, the aircraft stalled 1,900 ft. From the end of the runway before the right gear collapsed, to stop the slide.

Weather was generally unfavorable in most overshoot accidents. In 25 cases rain, snow, sleet or fog prevailed. Visibility was less than ten miles in 17 instances and precipitation ceiling at the time of the accident was under 1,000 ft. in 12 cases.

In no case was sufficient runway length attributable to an overshoot accident. Twenty-five of the crashes happened on runways 4,000 ft. in length or longer.

Convair Offers Japan License to Build 440

Plans to build the Convair 440 in Japan are under study by Japan Aircraft Maintenance Co., a subsidiary of Fuji Aircraft Co. JAL anticipates a requirement for ten short-haul aircraft by 1968 to replace DC-9s now in use on its domestic routes.

If commitments for an additional 40 aircraft can be obtained from the Japanese Air Self Defense Force, it is estimated requirements for Convair 440s via 440 aircraft in Japan.

Convair's proposal for building airplane manufacturing in Japan excludes rights to sell Convair 440s to other Pacific countries, but Japanese delivery would not be expected before 1968. The Japanese defense largely will not depend on domestic improvements.

Motivating against acceptance of the Convair proposal may be the Japanese strong public's aversion for foreign aircraft assembly, according to a JAL represen-



HULL 591104 of first Boeing 747-130 Stratoliner, destined for Pan American Airways, is hauled from a jig at Everett, Wash., plant. It will be delivered late next year.

First PanAm 707 Under Way



SECTION 43, being lifted from a jig board, is placed to one section (below).



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Bilateral Pact Gives KLM Routes To Houston, New York-Antilles

By Fred Estman

Washington—Netherlands and U.S. last week signed the first air bilateral agreement between the two countries despite strong opposition from congressional groups and U.S. airlines.

The agreement gives the Netherlands two new route concessions, a land route to Curaçao and the Netherlands to Houston, the other from the Dutch West Indies to New York. A Dutch request for a Netherlands-Luxembourg route was denied.

U.S. Rights

U.S. H. van der Bent, Dutch Under Secretary of State for Foreign Affairs, denied U.S. officials that he hoped to resume talks on the Netherlands-Luxembourg route when he presented the

U.S. rights to the Dutch. The U.S. airlines will receive rights to operate between Amsterdam on the U.S. Netherlands route. U.S. airlines who still have the right to operate beyond points already served on the U.S. Coast Zone route via intermediate points to Asia, Africa, Central, S. America and Panama.

Consequently, London, airline representatives and the head of the U.S. Chamber of Commerce had rapid Pre-

sent President Eisenhower that U.S. airline representatives be given no opportunity to present their side of the question to the President.

One airline spokesman said the Dutch are not making new routes into the United States for the purpose of saving traffic from Antwerp and Amsterdam to the U.S. They hope to make no trip to Amsterdam in a bid to carry more traffic between the U.S. and the huge cities of Europe and to the Near and Middle East.

CAB Figures

CAB figures show that an average of 19 passengers a month traveled between Amsterdam and Houston from September, 1955, to March, 1956, and that on average of 10 passengers a month traveled between Amsterdam and Los Angeles over the same period.

During the same period, the CAB said, there were 365 passengers a month between Los Angeles and Dusseldorf, Frankfurt, Geneva, London, Milan, Paris, Rome and Zurich. Between Houston and the same points there was an average of 111 passengers a month.

The airlines also claim that there are only five passengers a day between New York and the rest of the Dutch territory in Latin America, Canada, Africa and Australia. The Dutch want the airlines claim to expand between New York and Canada in order to give greater traffic to both between New York and Latin America and most areas of South America. The Air Transport Assn. informed the airline would be worth \$41 million a year to the Dutch as compared with the \$39 million value attributed to the New York-Netherlands-West Indies traffic.

The airlines also feel that granting the Dutch additional rights by a treaty that would be inferior to bilateral negotiations with other countries.

Commerce Reports Federal Airport Funds

Washington—Federal funds totaling \$15 million for the construction and improvement of airports at 194 locations in the U.S. and territories have been granted by the Department of Commerce for the 1956 Federal Aid Airport Program.

The project covers all states except Wisconsin and Wyoming. Funds are expected to reduce programs on the new federal to increase the total grant. Local funds to match the federal funds are available, or will be provided, in the states, counties or municipalities involved.



Chicago Helicopter Service Begins

Seven passenger Sheldy 4-15 of Chicago Helicopter Airways starts down Chicago skyline en route to Midway Field on Midwest and 17th Field on midwest pole and Midway en route. Totowa trip took 12 minutes ground transportation required four hours. Northwest Airlines has airline agreement for helicopter service to local passengers between O'Hare and Midway.

CAB Charges Flying Tiger Line With Violations of Charter Policy

Washington—Cord Airlines' Board last week began enforcement proceedings against the Flying Tiger Line for alleged violation of the Board's Transportation Charter Policy.

At its meeting, the Board revised its regulations in an effort to force closer adherence to the policy.

The enforcement proceeding, initiated by the CAB Complaint Office, charged Flying Tiger with failure to file required reports documents and other information and with violation of three sections of the Civil Aeronautics Act.

The CAB's petition for enforcement against Flying Tiger included accusations of frequent interpretation of Section 401(e) and grants in Central and South America as violations of Section 401 (a) of the act which prohibits such transportation without a certificate that the airline failed to comply with various CAB orders or imposed under Section 103 (E) and that it charged rates below the effective tariff, as set per Section 405 (B).

The airline has 15 days to file an answer to the CAB complaint.

The case was referred off to a Team World Airlines panel to file with the CAB if merit in which the airline sought enforcement and reinstatement of the Transportation Charter Policy.

TWA asked the Board to tighten the rules and to take appropriate action against carriers whose operations are being conducted in violation of existing rules.

"There have been repeated violations," TWA claimed, "where carriers have exceeded the cost ratios of their activities, made false or improper claims to loopholes the CAB and claimed that agency authority to operate transnational charter under exemptions."

Flying Tiger was cited by TWA "for repeated and continuous non-compliance with CAB requirements governing charter operations."

TWA and Pan Am demanded CAB regulation by setting transports to pay fares having no affiliation with group charters carried. In doing so, TWA said, the airline has effected extreme discrimination to the general public.

TWA also charged that some of the charter groups listed by Flying Tiger have been foreign, while others were created in an attempt to publicize the operation of charter rates.

More charges included by the CAB in its oral policy statement that went into effect last Thursday were:

various provisions of fast policy at appropriate conditions upon each individual exemption granted or certain prohibitions of the requirements will be referred to the Office of Civil Aeronautics for enforcement action.

- Board will neither grant blanket exemptions in an entire class of carriers to engage in such charter operations nor exempt all charter flights performed during an entire season, by a particular carrier. This means that application for specific exemptions must be filed for each proposed charter operation.

The Board plans to retain policy control over such charter services by passing rules on the individual merits of each application.

- Board will generally have the granting rate of applications that comply fully with the various terms and conditions of the Transportation Charter Policy. However, CAB reserves the right to waive any of the requirements in emergency cases.

The Board said that, in the past, more carriers engaged in transnational charter service have failed to comply with various aspects of the policy. Accordingly, it has decided to interpret the letter of the law in a strict manner.

IATA Asks Surcharge Increase

Washington—Proposed by scheduled airlines to add a 5% surcharge on transatlantic passenger fares on May 3 probably will gain strong opposition from the Civil Aeronautics Board.

Opposed by the CAB, or one of the unaligned governments involved, would block the revision.

In part operation, the Board has not looked favorably upon higher fares for international operations. Instead, CAB has advocated an increase in surcharges to prevent a reduction in fares resulting from the entry of other carriers operating the North Atlantic market.

A request to add a surcharge was made by the International Air Transport Assn. in behalf of all scheduled airlines operating over the North Atlantic.

Governments of the nations involved were asked for approval by the CAB.

Mr. William P. Holden, IATA director general, and the airline conference charged that the surcharge is necessary to avoid a serious financial emergency caused by substantial operating cost increases since levels were first considered last May 18.

The new rate that fares could be increased in normal course would be next September, to go into effect is April, 1959. With a profit margin that has always been precarious, we simply cannot afford another 12 months of increased fuel costs.

Board action is in the matter will be taken after staff recommendations have been received.

Earlier, the CAB announced that it would permit a 10% increase in passenger fares proposed by the two certified carriers operating in the Territory of Hawaii. Subsidies with the assumed form, which became effective April 1, the annual subsidy of both carriers, estimated at \$183,000, will be reimbursed. The airlines are Pacific Airlines, Inc. and Trans-Pacific Airlines, Ltd.

In expansion in action, the CAB and the new lists of the two carriers would now compete directly with those of other transpacific carriers and would now provide them with uneconomical carriage.

The Board also said the fares of the two Hawaiian carriers were not related to the fares charged by domestic airlines operating in the continental U.S. since the price is in terms of seat, volume of operations and related factors. The two different price levels of domestic transpacific carriers.

The CAB is now conducting an investigation to determine if segments by seven transpacific for a 5% fare increase is lawful and justified. The increased rates filed by the carriers were suspended pending the proceedings which got under way with a hearing last week (AW March 28, p. 40).



RUSSIAN-BUILT IL-14 with Chinese Communist airline markings waits for takeoff at Kunming. Kunming is terminus of civil routes to Southeast Asia and the route to and from Southeast Asia. Flight operates twice weekly between Kunming and Rangoon.

Kunming Is Chinese Southeast Asia Terminus



Mechanics repair Il-14 at Kunming (left). Tail of D-34 night-fighter terminal building at Kunming.



AIRCREW, using chopsticks, at rest at Kunming. Control tower operator Eng/Md at Kunming takes a smoke at right.

Soviet Passengers Wait, Wonder, Freeze

By N. Klaas

Moscow.—The ordinary scheduled airline flight is not devoid of a certain amount of suspense. When we, passengers can't help but be bothered by such trivial and thoughout unimportant problems as the plane's departure time, temperature in the airport, the order of landing in the planes, dinner times en route, etc.

Our "traveler" was Venskaya Airport (Moscow) to Rangoon on Flight No. 1. Details of the departure time (10:10 at 4:21 a.m.) The bus from Silverleaf Square left at 3 a.m. To remember these figures.

The passengers for the flight gathered at the Silverleaf Square bus stop at 1 a.m. That's no surprise. We all crowded together in a long line about an hour before the bus departure time (10:10). Was it possible that the passengers from other flights had to go to Venskaya Airport so long before the designated travel?

Not at all. The Moscow Airlines ticket office handed out each the famous "Passenger Handbook," which said that the last bus left for the airport at 8 a.m. The passengers, naturally, were faced with the problem of where to be later. They believed the handbook said, as it is, they'd folgered a whole hour. At 8 a.m., the bus left.

The usual pre-flight bustle prevailed at the air terminal. Now and then the bus would stop to let off passengers.

The passengers on Flight No. 3 were to spend about two hours at the airport. One could walk away for three reading newspapers or magazines in the waiting room. However, you had to bring your own reading material with you. The air terminals are usually closed at night even though flights are made around the clock.

Departure Delay

The time flew over for boarding our plane. However, for some reason the headmaster insisted when people began to get serious. After the passing question, "What's wrong? Could there have been a fire?"

Passenger headed for the information bureau. There it was explained that the plane would leave at 4:10 a.m. "Please, sir, one of the passengers," he says on the ticket, and we were told of the city ticket agency that.

But what does it matter what the ticket says. Departure for Flight No. 3 is scheduled for 4:30 a.m., and it must leave only at that time. The man on our ticket said that the plane departed at 4:35 a.m. returns on the ticket agent's concession.

Then we waited another 45 minutes.

Aeroflot Critique

Continued review of an "ordinary" Aeroflot flight from Moscow to Kunming which begins on this page (we translated the Aviation Week item "Catastrophic Aviation," the state-owned airline's off-field magazine). The author, N. Klaas, is described by the magazine as a "Special Aeroflot representative." Aeroflot criticizes the airline's handling of passengers both in the air and at Soviet airports, who have apparently already seen the Moscow daily press.

Twenty minutes before boarding time we were invited into the transit lounge. Whoa! We were told that this flight No. 3's itinerary would be changed to include a night stopover at Rangoon.

Without further explanation we were handed small sleeping bags. The passengers continued on their way, some having been invited to the gate. But then it turned out that on our particular account heading for Flight No. 3 would take place through the transit room. So we had to return there.

Bell Cell

We went out on the platform. Be fore taking on onto the field the lady attendant hurriedly called me and said she didn't know if the passengers were staying the night here or not and to the trainmen. We waited.

Finally she appeared again, announced the passengers and led us to the plane. We checked the stops and were re-assured once more. The lady attendant came up to the trainmen. In a few minutes, panting and puffing, she flew back to the plane, announced or left the train, waved her hand, and left.

After this, she did not see people judging her as being indecent; she had been extremely critical as the passenger train.

The engine started. The Il-14 took past No. 3/7/30 rolled along the strip and out onto the runway. It stopped there a little while, then started moving, gathered speed and effectively left the ground. We were off.

The flight went along smoothly. We would have liked to thank the pilot for the good training, but he was the last to leave the plane. The passengers sat in silence, except for the lack of conversation. Yes, and it is nice to know who is piloting the plane you are flying. One could say that those few were very good role models down below. Before each flight, the plane's captain must greet the passengers, tell them who is to accompany them, give them some information on the coming trip and

advise them of the facilities aboard the aircraft.

The direction was posted on the sub-drawers. But in many cases it hasn't been completed yet. Can it be that the pilots consider it depending on them to become acquainted with the passengers?

Dinner began to taste... The cooks could be seen through open doors in the corridor. The phone descended and made an early landing.

A young boy in a dark blue dress was standing by the door. "Caveous passengers! We have landed at Bangkok! There is a meal hour stop."

It turned out that we had a break in our plane. We had originally believed that we just needed to travel. Who she was given no indication of who she was until landing at Silverleaf.

The phone rang in the terminal. The train men rolled up to the door, and a lady attendant showed up.

"Good evening, passengers! Your plane has landed at Bangkok," she said. "There will be a stopover of about two hours."

But this just told us that the stop is for one hour," said one of our crew members.

The non-understanding was explored. The train men called for a landing at Kunming. But because of poor weather we overflew Kunming. Therefore the Silverleaf stop was extended to three hours. The lady attendant showed our flight number, 3, on the train. All passengers were asked to remain in their seats until the connection had been established. It is a "rule" of the airline to avoid short flights at the destination of a stopover of an intermediate airport.

Silverleaf Terminal

We headed for the air terminal. Our seats, the building's facade made little impression. It was a gray building with not any special decoration, but made in a very different style. The first thing that struck us was the openness and comfort. Everything is clean.

There is a restaurant to the right of the entrance. To the left is a large hall and waiting room. In the first waiting room are tables with the metropolitan and local newspapers in plastic holders. In the second waiting room was a kiosk that was open and doing a good business in newspapers and magazines despite the cold heat. The wait was long, but they did their best for passengers waiting their planes.

The restaurant stop was also good. Waitress served us by name in a personal way at a table. The food was served quickly.

The menu was varied, and the items were prepared quickly.

One involuntarily compared the operation of passenger services here to



10 TONS OF FREIGHT!



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VANGUARD freight capacity!

Ten tons freight holds with a total of 1000 cubic feet, yet the new Vanguard freight liner has the capacity of an entire freighter! And freight has drag. So far, the Vanguard has had a 7% fuel saving. The Vanguard has fast, F-4 time down the line. It reduces ground handling and eliminates loading and unloading to reduce ten-second time considerably. The Vanguard's tremendous cargo capacity is a positive feature of its unique "double deck" design. As a result, "double deck" freight, as a result, for Vanguard.

A FRESH-THINK *money-saver!*
Not only do the freight capacity grades, but the passenger capacity beat the cargo deck of the Vanguard is a true cargo potential which capable of accommodating up to 115. The lower deck can carry the Vanguard's full payload without any modification to the passenger cabin. During off-peak periods, the Vanguard can still be a winner under current freight rates! The Vanguard is powered by four Rolls-Royce Tyne turbo-props... it will cruise up to 427 mph for 2600 miles with a full payload.

Experiments have been substantial!
See Vanguard's all but 2,000,000 hours of VANGUARD experience.

**turbo-prop VICKERS
VANGUARD**

POWERED BY FORD MOTOR COMPANY

The passengers were affluent and affluent. The waiting room was also very nice.

We flew on to Irkutsk, during the night, arriving primarily on schedule.

Here we are and our travel costs. Undoubtedly other flights are better or faster and the service is more efficient but even if we conclude that all of our troubles with the result of the happenstance one may still be in holding to ask: "Wouldn't there be an awful lot of an enormous backlog for our flight?"

SHORTLINES

► American plans to stop at Puerto Rico instead of Barbados on its new New-Orleans-G. Constitution round-trip between South America and Europe. Between certain route changes, which would be effective in May, is subject to CAB approval.

► Four Radial C-46 conversions have been ordered by Western Transport, British, according to Radial. Airlines uses its transport category conversion order now total 59.

► Northeast Airlines put its second DC-6R into New York-Miami service on March 25. Plane carries 50 passengers in transatlantic seating and luggage.

► American Airlines has ordered RJA weather radar for its DC-6 and DC-6B passenger planes, who for its DC-6B cargo aircraft. DC-6s are already equipped.

► KLM Royal Dutch Airlines netted \$6 million last year, a 37% increase over 1955. Total revenue was \$157.5 million for the year. KLM's 1956 capacity totaled 734.2 million ton-miles, and load factor was 80.5%, up from 58.5% in 1955.

► The Canadian tourist to fly the North Atlantic crossed at night during first week of March, according to International Air Transport Association. This is the first time that the airline has done so for years after tourist service began on the route. IATA statistics show Number Two Miles was made, only 40, exceed \$7,000 or less, had never been before.

► New York-Borneo route was made by British Airways at 12 hr., 20 min. at average speed of 362 mph. The 100 turboprop departure followed at 175,000 lb. gross, cruised at 25,000, initial long range fuel consumption rate with fuel for 150 miles of 4.95. Payload was 18,000 lb., including 40 passengers.

AIRLINE OBSERVER

► Airlines will intensify their campaign for the abolition of 3¢-the-gallon fuel taxes as a result of the pending increased rate of fuel consumption in the operation of turboprop and turbogear transports. Capitol Airlines already has felt the additional pinch of state taxes with their Vanguards, and that experience is forcing other carriers to face the seriousness of the problem. Current target of the airlines for fight is Alabama where seven cents per gallon of gasoline, kerosene and other fuels is highest in the U.S. Alabama legislative session is May, and the airlines are hopeful that that of reaching at least a compromise concession that may not present taxes as little as the cost per gallon.

► Brazil Airways mechanics voted International Assn. of Machinists to their bargaining agents in place of the Air Commerce Mechanical Assn. in a recent National Mediation Board election.

► Bell Rover-Dart turboprop engines have recorded over two million flying hours of scheduled airline operations, one-half of which was accumulated in North America.

► Western Airlines will introduce an Lockheed Electra turboprop on its newly-named Los Angeles-Mexico City route.

► Convair has placed orders for more than 512 million of heavy machine tools for use in the construction of the \$80 billion target. Capital funds for an additional \$2 million worth of heavy tools and other special equipment will be obtained shortly.

► Air Traffic Control Assn. has protested to the Air Line Pilots Assn. over the manner in which ALPA's council cross-appointed controllers while taking depositions in connection with pending Civil Aeronautics Board proceedings involving alleged violations of air traffic regulations by Capt. Leonard Spiegel, TWA pilot (ALPA Mem. 10, p. 30). ATCA claimed controllers were cross-examined as if "they were hostile, adverse witnesses in a criminal prosecution" and were not treated "with the consideration to which witnesses are entitled, who earnestly try to present objectively the facts about which they are questioned." (See page 36.)

► American Airlines will reorganize its flight department to reduce top-level management numbers from current status as planning, procedures and policies for the introduction and operation of turboprop and turbogear transports. The program calls for department decentralization through the establishment of four regional flight offices. Division within the department headed by T. E. Lloyd, vice president-flight, are Flying Operations, Dispatch, Services, Service and Communications and Administrative Services.

► Capital Airlines will report a passenger traffic increase of 65% for the first quarter of 1957 over the first quarter of 1956.

► Trans Canada Air Lines became the last scheduled airline in North America to drop the requirement that passengers be registered members. Most airlines discontinued the ruling during World War II because of the sheer age of war.

► Seaway will rule out purchase of the Scottish Aviation Twin Pioneer because of the aircraft's single-engine performance. Short-field performance of the STOL aircraft has been exceptional during a three month trial period but static endurance speeds are too high to have considerable reserve of altitude with one engine out.

► Eastern Airlines increased aircraft utilization from 7 hours, 8 minutes in 1955 to 7 hours, 16 minutes last year, an increase of 7%. Utilization of the DC-7, which represents one-fourth of the airline's varying rapidly increasing aircraft.

► North Central Airlines plans to increase flights on its Wisconsin route segments as a result of a petition by the Chicago and Northwestern Railroad to discontinue 28 daily trains on its runs between Chicago and Madison, Milwaukee and Minneapolis-St. Paul.

Another reason why G.E.'s newest turbojet makes possible

the ideal medium-range jetliner



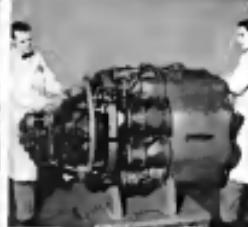
1933—General Electric's Dr. Strobel more successfully devised a way to burn pressurized fuel in a chamber, thus energy to drive a turbine wheel.



1938—General Electric developed the first successful turbosupercharger, based on Mois' gas turbine studies. Dr. Mois (left) stands with USAAF pilots who conducted tests.



1939—TWA plane proved turbines could be used as airfoils for higher, more economical flight. Meanwhile, G.E. began its first turboprop studies.



1940—First U.S. jet, the T-33, was developed by G.E. from British design (at USAAF request). G.E. shifted turboprop project for duration of war.



1943—Jet Age begins in America when Bell P-51A—powered by time General Electric's J47 (turbojet)—flies at over 400 mph on record flight of Moron.



1944—To permit high-altitude bombing of Axis, G.E. built two kinds of turbines for B-17, B-52, and B-36. Meanwhile, company engineers worked to perfect new jet engines.



1945—USAAF's first operational jet transports (Lockheed P-80 "Shooting Star") flew with General Electric J33s, but centrifugal-flow jets G.E. built



1946—General Electric's first J35, installed in B-57, F-86, and B-47, became America's most-produced turbine jet. From 1947-56, more than 31,000 J35s were delivered to Armed Forces.



1953—50% more powerful than the J35, the J33 jet engine was evolutionary in design, incorporated many new features for supersonic performance.



1956—G.E.'s major G.E. program in reducing engine weight and S.P.C. while increasing performance was typified by the T38 turboshaft engine. This is now being tested in Balsawood's F-86.



1957—The world's first advanced jet engine—the J79—today powers the world's fastest fighter, the F-104A, and the U.S. supersonic bomber, the B-58.



1957—General Electric's new CJ-805 for medium range jetliners boasts the record of jet travel for all America. Engine will enter airline service in 1966.

When you use General Electric's CJ-805 you benefit from 54 years of gas turbine progress

Fairly, General Electric has more jet engine experience than any other manufacturer. As a result, the new General Electric CJ-805 offers benefits no other powerplant can match in medium-range operation. The CJ-805 gives you—

- the best S.P.C. at cruise and climb power
- the lowest operating maintenance cost
- the best engine size and weight for medium-range operations, and
- complete support services, including experienced G-E tech reps and a world-wide jet service network.

Your assurance of top CJ-805 performance is General Electric's 54 years of experience in the gas turbine field. Ever since G.E. first coated the first successful turbosupercharger, the company has helped speed aviation development. The CJ-805, a direct result of G-E experience, promises to be the most economical engine in the world to own, operate and service.

For more information on what the CJ-805 can offer your medium-range jet transports, see below. General Electric Company, Cincinnati 12, Ohio.

10-68

COMPREHENSIVE DATA on why the CJ-805 makes possible the ideal medium-range jetliner is available to qualified airlines. To see this presentation, contact a G-E District Aircraft Engine Specialist via your nearest Aviation and Defense Industries Sales office.



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MISSILE ENGINEERING



MISSILE site proposed by Baldwin-Lima-Hamilton includes buildings, housing, precision machinery for rapid assembly and disassembly of large volume of missile systems and components, and enclosed tower crane for final assembly. Railcar loads in submerged launching shed.

Launcher to Weigh Missile, Test Thrust

By J. S. Butz, Jr.

WALDORF, Miss.-Impressed ground transportation for testing and launching heavy ballistic missiles has been proposed by the Baldwin-Lima-Hamilton Corp., proposed launcher uses launching plant which transports entire payload of missile, test equipment and weight in hot storage before take-off to improve missile accuracy and reliability.

Weighting system of launcher proposal is integral part of the test launcher. Weighting units are storage load cells and the complete installation is accurate to 1/4 of 1% in the range between 10% and 100% of maximum missile weight.

The proposed precision in weighing heavy loads contributes significantly to improved missile accuracy, as trajectory programming is only as good as missile weight data.

Weighting system is only one element of the new launcher, which is water-mounted to incinerate all of the forces acting on the missile until the instant of launching. From this instant on, which is displayed visually, the launcher will apply a constant force to launching plant below light-weight. The Baldwin launcher then loads the missile while the rocket motor is started and run up to full power.

Thrust is measured by the launcher and the crew can observe the thrust

build-up in its entirety. If there is any sign of improper operation, or if the thrust fails to reach take-off magnitude, the motor can be stopped. If the rocket operates properly the missile reaches a velocity of 10,000 ft per sec.

The launcher will reduce the number of accidents in which a missile made discharge enough power to lift it a few feet in the air. The single throw sets back to the launching area and explodes. Douglas' Thor IRBM is fired in this manner at night (AVW Feb. 4, p. 54).

The Baldwin launcher also provides instrumentation measuring any measured parameters to provide a self-propelled maneuvered thrust or word load. This data is fed through a servo loop into the missile control system, which can correct for these anomalies before reentry and prevent any abrupt movements as the missile moves off the pad. Such abrupt movements may have an adverse effect on the guidance system.

The value of such a system would be substantially increased during launch operations from a moving vehicle such as a warship. It could present instantaneous a complete picture of the missile's performance. People who doubt that the timing, peaking speed was as par to the missile. The missile can tell others could corroborate these movements if the missile could be restarted and the movement passed through a zero point and then fired

The Denver Division of the Martin Company has purchased the Baldwin launcher for use with the ICBM Thor. Several missile projects including Thor and Vanguard are to be implemented.

Baldwin says it has implemented the weighting and storage

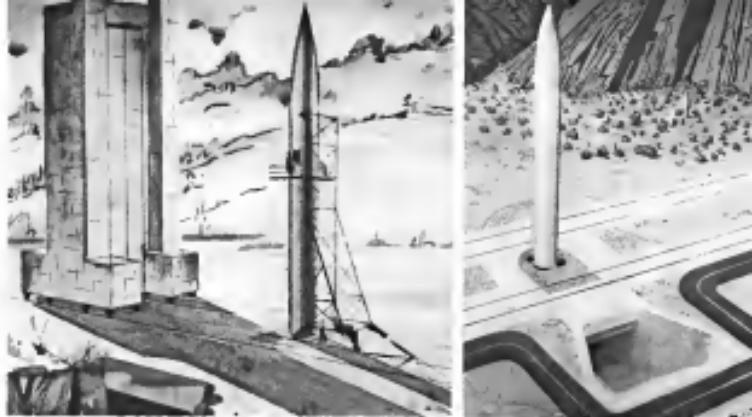
The precision achieved with the Baldwin weighting units is not easily attained outside the laboratory, but it is invaluable if the long-range ballistic missile is to be effective. ICBM assumes, for instance, that accuracy is of 1% (plus or minus 5 miles in 3,000) at target destruction must be certain. Two or three percent error in weight can add to the distance programmed before hitting the center of mass portion of the missile flight. Worst situation occurs when fuel and engine weights are not measured in proper sequence and several hundred pounds of excess weight remain in the missile.

The ease and weighing accuracy provided by the Baldwin units required in the launching stand have never been equaled by any other method, company says. Previously empty missile weight was determined from the total weight of the missile plus what went into the launching device. People who doubt this claim often measure the volume of the liquid placed above the missile. Launching weight was then a computed value whose accuracy was influenced by a tank calibration, temperature errors

and the like.

Techiques and techniques for the rapid assembly and calibration of heavy equipment which have been developed in a economically competitive industry will be of considerable benefit in solving this problem.

Baldwin-Lima-Hamilton's approach for improving missile sites draws heavily upon proven techniques for assembling and checking out large structures and tool assembly. Its experience has been gained through years of successfully competing in producing accurate, accurate tools made of various materials for weighing, and calibrating the output of heavy industry.



SELF-PROPELLED load assembly (center) contains equipment for fast pre-launching checks and allows work to continue in any weather. Submerged launching shed (right) facilitates placement of the missile.

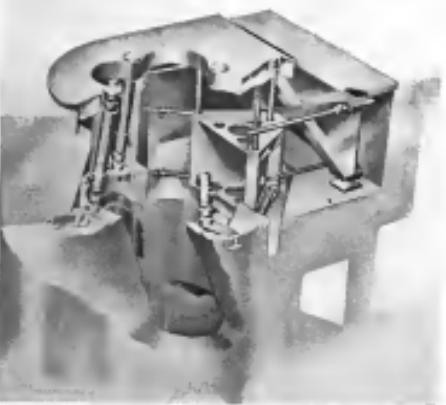
time, and laboratories kept weight to

control. "The system of weight checking obviously could not be accurate to less than 1%, which was required. The Baldwin units save much construction weight in launcher assembly and the cost of launching. Missile weight factors considerably due to the large quantity of low temperature coolant stored. The smaller tanks save rapidly under atmospheric conditions.

Requirements for an efficient site are rather clearly defined in the light of so-called current experience. Facilities which are being considered for launching will have to use and largely substituted quantities of large ballistic missiles which will be available a few years hence.

The rapid and accurate check-out of missile systems and components will be extremely if not essential.

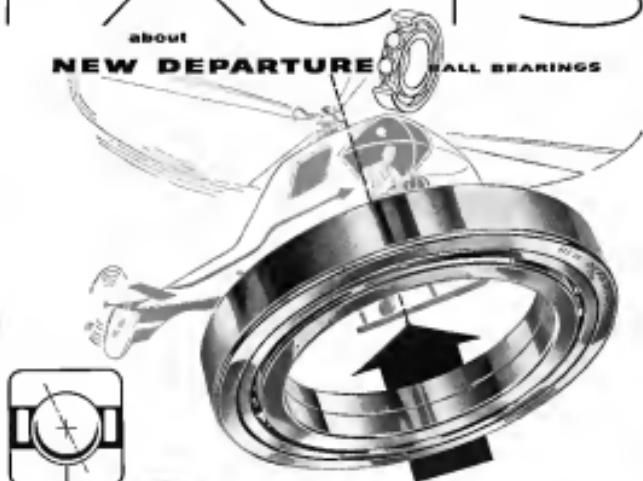
Techiques and techniques for the rapid assembly and calibration of heavy equipment which have been developed in a economically competitive industry will be of considerable benefit in solving this problem.



NEW TYPE launching rail improves missile accuracy and reliability by providing closer control in the final search before firing. Stand measures thrust, weight, and air distribution which results from low-speed wind tunnel balances. Stand loads are measured by strain gauge load cells.

FACTS

about
NEW DEPARTURE BALL BEARINGS



LOADS GET A LIFT with THIS BALL BEARING

Whether in helicopters or jet engines, New Departure ball bearings of split inner ring type provide very high load capacity. That's because the separable rings permit high race shoulders and a greater transfer of loads of large size. These split inner ring ball bearings not only carry heavy thrust loads in either direction in addition to radial loads (with thrust predominated), but they have important application advantages.

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AERONAUTICAL ENGINEERING



BOEING B-52 long range bomber, based in MRC-27 fighters, four turbojet engines which develop 13,000 hp.

German Deportee Describes Bear Engine

Genoa—The 12,000 rpm Type K turboprop that powers the four-engined *Riesen* (the) long range bomber is the final result of a four step program that began 11 years ago in Kielhaven on the Volga River.

Developed by German engineers at Junkers and BMW, the first engines produce 3,000 shp, plus residual thrust at their design altitude of 36,100 ft.

Specific fuel consumption reaches a minimum of 0.332 pounds per horsepower hour.

The Type K turboprop is a single shaft engine with a 14-stage compressor and a five-stage turbine. The case housing classifier is a canopial type, containing twelve individual bearing units in an annular combustion chamber layout and construction is quite conventional by contemporary standards and is based to large measure on the extrapolation of advanced German aircraft designs that led to the achievement of the Type K engine about eight years later.

Report on Lecture

The article is based on a report of Braden's lecture that appeared in the Technik section of the Neue Zürcher Zeitung, authoritative Swiss newspaper.

The 34-stage available compression ratio in engine diameter from 29.5 in. at the first stage to 19.1 in. at the 14th stage. Impulse velocity is 3,866 ft. per sec. at opening speed. Rate of loss of total diameter at the start is 0.45%. The German reported

Inlet Temperature

Intake inlet temperature is 1,150 degrees Kelvin. Intake air density and about 91 lb. per cu. ft. at sea level. The pressure loss across the housing is 3.5% and the combustor efficiency is 95%. Use of the bypass section is between 30% and 100%.

The complete assembly weighs about 97 lb.

Overall adiabatic efficiency of the design point is 84%.

Combustion chamber inlet velocity is about 164 ft. per second and the intake air passes out of the chamber at 471 ft. per second. The pressure loss across the housing is 3.5% and the combustor efficiency is 95%. Use of the bypass section is between 30% and 100%.

The complete assembly weighs about 97 lb.

As previously mentioned, the compressor casing is used to start the engine. The little east has a radial compressor, a radial combustor chamber, a turbine and reduction gear. It develops 65 hp, weighs 331 lb., and has a diameter of 11.8 in. and a length of 29.7 in.

Compressor efficiency is 80% and the turbine efficiency is 87%.

Propellor for the B-52 installation

was. Russian developed and of good overall efficiency. Testing time was in the order of two or three seconds.

Project History

Judson had been working on the development of a jet engine with an air throughput of 122.3 lb per second when the war ended. The first job assigned to the Judson Collective was the development of the Judson 012 turbojet engine, which had been designed during the latter months of World War II.

The propeller had a diameter and a specific fuel consumption of 4.66 lb per pound per hour.

Other jet engines suitable the Judson 012 and the BMW 101, were taken to Russia at equivalent but were never developed in large numbers in production. These essentially primitive propellers were used as shippropellers and larger and more advanced engines were developed.

The 012 engine had a 12-stage compressor with a pressure ratio of 4.15. The air input was 152 lb per second and the operational speed was 6,180 rpm. Engine diameter was 46.7 in.

Bleed for Starting

One of the first things learned during the development work with the engine was the necessity of bleed for starting. The combustion chamber was a departure from the usual German practice.

It was developed basically in 1947

at a 12-lb/sec. airflow, passed in an annular chamber. The first tests had a schlieren loss pressure loss of 7% and a combustion efficiency of about 94%.

Two months before completed the development of this engine in 1948, but started an investigation of the relations between high temperature strength and the grain size of the blade materials.

The chief value of the work with the 012 was that it provided a backlog of experience for the records center.

Russian Specification

The next project undertaken by the Russians was a 6,000 rpm turbojet designed for a flight speed of 500 mph at sea level. Propellor diameter was to be 13.8 ft. and the gear reduction was to be 7 to 1.

Two years later the requirements were met with the type 012, developing engine with the following dimensions: 1,780 lb. dry weight, about 1,220 lb. maximum weight, 20 ft. long, 1,000 rpm, shaft speed of 6,000 rpm, gear reduction, 7.995 rpm, specific fuel consumption, 0.54 lb/lb-hr. Thrust diameter, 61.3 in., engine length, 14.8 ft. The combustion chamber had an inlet velocity approximately 300 ft. per second.

By combustion efficiency was 98.5% with a 2.5% pressure loss.

The success of this project stopped a parallel program that a Russian team was developing, and also started another set of detailed specifications. The



Career opportunities for:

Research, Development and Production Engineers

MANY NEW AERONAUTICAL programs—such as the Vanguard Reference Guidance Reference System shown on this facing page—have come here for the development by Honeywell Aero. These advanced programs offer exciting career opportunities for engineers in such areas as:

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ENGINE INLET DIFFUSER DESIGN
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Opportunity through growth! Engineering personnel at Honeywell Aero has tripled since 1951, and is still growing rapidly to meet the needs of our programs. Future growth looks even more promising, for rapid technological changes in the aeronautical and missile fields are changing more and more complex mission flight control and weapons systems.

Developing and producing data systems is Honeywell Aero's best news. Honeywell Aero pioneered the development of the first practical use of all electronic data processing, as well as early entrepreneurship in the U.S. producing a computer line. Honeywell has produced over 45,000 digital control systems more than any other manufacturer, and has been the leading supplier of Litak, the state-of-the-art solid-state bombing system. Just like today we are expanding field of instrument controls. Make Honeywell's growth, your growth and life your future with opportunities.

Act now!

For more information about your career opportunities in Honeywell Aero, write or call: Mr. W. E. Tamm, Technical Director, Dept. TA10, Honeywell Aero, Minneapolis 21, Minnesota.



Here is the first photograph of the guidance reference system for Project Vanguard.

Designed and built by Honeywell Aero, this sensitive electronic mechanism must keep the finless rockets on course despite intense vibrations and tortuous accelerations hitherto unknown. Because of these rigid demands, rugged, precise HIG-6 gyroscopes were selected to sense pitch, roll and yaw in the system. The Vanguard Reference System is another example of Honeywell Aero's leadership in air-borne control systems.



Mach 5 Wind Tunnel

Chase Vought Aircraft's new Mach 5 wind tunnel, shown here in cutaway as required to be made for the aircraft industry, is January, 1958. Located near Mountain Creek, Texas, the \$1,000,000 tunnel was constructed at standstill in the Pit tunnel on the left to speed up development of transonic flight through the supersonic test section in front of the control nozzle on the center building. The air is then exhausted through a silencing tower at the right which Chase Vought says, will a quieten noise down.

Honeywell

AERONAUTICAL DIVISION

AERONAUTICAL DIVISION, MINNEAPOLIS/HONEYWELL



Antennas were previously made by non-precision-made 1-in. rods like this.

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**THE COLUMBUS DIVISION OF
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aircraft will be available in 6 yrs. and 10 mos., possibly as late as 1960, if no further delays occur.

Named the Sea Vixen, the fighter uses a unique wing, double-surface, modified tailless design for greater deck clearance, longer endurance, more maneuverable, undervisible and lower noise level.

Then there is the F-104.

The F-104 will replace Sea Vixons in the Royal Navy's fleet of modern fighters. Performance details were not released but the intercepter is expected only in 1962.

Flight refueling trials have been conducted with a prototype to increase on-station and range.

Missile Nose Spike Is Recovery Device

London-Bristol Aeroplane Co. has released details of a supersonic test vehicle used in development of the firm's supersonic missile and the Thor nuclear missile.

Named the Balloon, the test vehicle employs "reusable" characteristics to drop down from high speeds so it can be recovered for reuse. A long upward nose spike cuts the ground when the vehicle strikes the earth.

Balloon says if this is possible to re-use the Balloon virtually unchanged after test flights.

The slender single stage vehicle appears to be about 36 ft. in length. Test is done of the nose spike was made by dropping a dummy vehicle weighing four tons to see what it would hit the ground at the end of its 10-second flight.

Parachutes for the Balloon were developed by the British firm and CO components. Balloon punctures are prevented by a tissue shield while the vehicle is at supersonic speed. After partial deceleration, the small chutes are released, driving out a main canopy 30 ft. in diameter.

New Tenant Sought For Hawker Plant

London—Relocation in the defense program makes it impossible to provide the Hawker Aircraft Co. plant at Blackpool further space.

Manager of Hawker says another tenant will be sought after Hawker's own next project is terminated. Although the intention of other companies has been denied in the locality, one set has not been found.

The Blackpool plant is the largest single aircraft production unit in England. Cancellation of orders for 180 Hunter fighter-bombers has begun laying off more than 1,000 workers employed there.



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Outboard location of twin Franklin engines simplifies servicing, replacement and cooling and leaves ample cargo space for "flying cargo" applications.

BELL HELICOPTER'S Omega SB-12 is a tremendously promising approach to greater helicopter design simplicity and improved utility. Maintenance costs, long an obstacle to wider helicopter use, promise to easily qualify this innovation in design. The SB-12, with its two 210 h.p. Franklin engines, has a maximum payload edge over single engine helicopters. With a capacity of pilot and 4 passengers or pilot and 1000 lbs. of cargo, the SB-12 should find a wide field of utility.

We are naturally pleased that like 75% of all the helicopters flying today, the Omega SB-12 is powered by Franklin.



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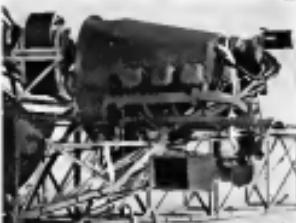
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Large cargo space immediately below rear shaft at approximate c.g. will accommodate 1,000 lbs. of cargo when helicopter is used as "flying cargo" without passengers.



Detail of engine installation shows easy accessibility and efficient V-belt drive which greatly simplifies gearing and minimizes vibration.



FRANKLIN fastened plastic seat cushion (above) was developed for use with cord strap (below) and.



Shock Absorbing Seat Reduces Injuries

A shock absorbing seat to reduce the number of back injuries suffered in hard landings has been designed by Claude Voight, engineer. Spiral springs are extra cushion in jet fighters because the pilot sits in his harness where the downward swing of the nose after the downburst owing to the nose after the nose which have reached multiple impact loads.

Similar seats are being installed in a number of Navy aircraft. It was originally made for the F7U-3 Cutlass.

The seat is suspended on a starboard seat strap which is attached in upper and to a seat belt built-in belt on the rest. In a hard landing, the seat strap stretches and lands on a shock energy kinetic storage. There is little or no spring action and the permanently stretched strap must be replaced after serving its purpose.

The strap suspension was originally suggested by Christopher T. Kaestner, now of the Navy Air Crew Equipment Laboratory.

Voight has developed a Franklin fastened plastic seat cushion for use with the new suspension which is constructed to prevent the pilot's hips from sliding forward in the seat. The forward part of the cushion also supports the thighs in an ejection.

Two suspensions with instrumented seats and drivers seated were subjected to simulated hard landings. One was used to determine loads transmitted by standard seats and the other was used to test the new suspension and cushion. A significant reduction in loads was registered for the latter.



Which is the "helping hand"?

Ever consider that this thing we call Big Business is much like the economy of the U.S. itself? It's complex — it's dynamic — and it's constantly improving. Yet Big Business is not, and likely never will be, self-sufficient.

It is said that our smaller businesses are being crushed — squashed out. Some inefficient ones will be. But not the ones who are making a real contribution. For example:

Freespace, pinioning the bitter grip of the spring-type clutch (an older type of roller and clutch device), contributes added performance and efficiency to many products of manufacturers, both large and small. In so doing, it performs the function of the smaller specialist, from whom the major corporations are removing important help.

This is U.S. industry's way. Big Business and smaller ones join hands in the interest of mutual betterment.

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A2-4C





QUANTICO HR2S-1 prepares to pick up howitzers used to move of battle or combat development operations.

Marines Put HR2S in Operational Status



MARINES AT QUANTICO load a 105 mm. howitzer into HR2S-1 during Fleet Introduction Program flights.



MAINE BROWNSVILLE HR2S-1 at Quantico loads in rough terrain to mobile gear, which is being driven through climbable doors.

By Claude Witter

Quantico, Va.—Accelerated Fleet Introduction Flight Program of the Sikorsky HR2S-1 twin-engine helicopter has been completed at the Marine Corps Air Station here. A new squadron, HMR(M)-461, is ready to begin flying exercises at its home base in New River, N. C.

The squadron commander, Lt. Col. G. R. Doyle, 11 of his pilots and 47 enlisted men have undergone six weeks of intensive familiarization and operational training with the new assault

The major squadron version is to provide assault development transport for the Second Marine Division at Camp Lejeune, N. C.

HMR(M)-461 is the first Marine helicopter squadron to use the new HR2S-1, which, in turn, is the first twin-engine helicopter to go into military service. It also is being purchased by the U. S. Army, and the ground forces have had a team here to observe the Marine training program.

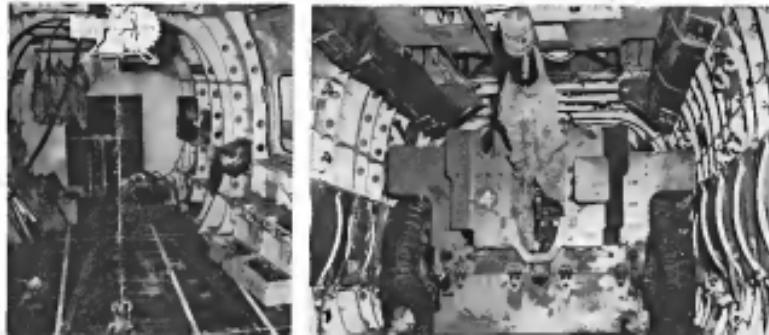
In more than 200 hours of extensive exercises, the Marines found no need for major modification of the HR2S-1.

A number of small discrepancies that were anticipated will be corrected by the manufacturer as soon as feasible.

The Indians underwent some major changes before Fleet status was deferred. Diameter of the rotor disc, for example, was increased from 65 to 72 ft.

The Fleet Introduction Program (FIP), as set up by the Board of Aviation Services, calls for about 100 hours flight time on each of four aircraft. In the case of the HR2S-1, this mark was not reached but sufficient experience was gained to justify entering the new

OVERHEAD WINCH in cabin was used to pull howitzer onto HR2S-1 cabin (left). Loaded howitzer is tied down (right).





Only the men are flying

The fact is, even best birds at their own game. Even when our feathered friends are grounded, we're aloft. Flying ever higher, faster, safer, harder. And, heli-cool as it may seem, more accurately.

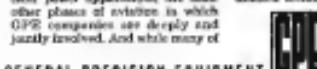
Among the companies spearheading man's conquest of the sky are none of the GPE Group. Their contributions are basic—technological breakthroughs such as—

- * the only stabilization to meet the need for on-the-ground testing in aerospace flight. Inseam Link jet stabilizers.

* the only airborne navigation system in operational use guiding planes automatically and with unprecedented accuracy—anywhere, in any weather. GPE Doppler auto-navigators.

Aeronautics is but one industry in which the GPE companies work. A brochure describing the activities of the group is available. More than a dozen basic industries are served by products resulting from GPE centralized technologies and resources.

- * the only compass systems that always know where north is, whatever the plane does, whenever it goes. Kellett's stable-platform gyro compasses.



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man aloft



The pilot—before he can open the hatch before he can land in the aircraft over there—but already "down" in the ground, in a Lockheed F-104 Starfighter, was a man who had just been honored "Liftoff" at MacDonnell's 1967



Mohawk. Right, there's another liftoff moment—this time in a Bell AH-1G Cobra attack helicopter developed by GPE's MacDonnell Douglas unit—and that's the GPE companies work in aerospace. Once these classified products are no longer classified, however, everyone will enjoy their benefits.

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AERONAUTICS, April 8, 1977



Kellett KH-15 Demonstration

Kellett KH-15 was first helicopter powered by two Reaction Motors (a modern liquid-hydrogen rocket) to fly a network television program demonstration. Other antennas were positioned by the helicopter, enhanced "Solid State" imagery of its heading problem

program to proceed on schedule at New River.

At Quantico, the helicopter operated from landing mats in the field to rough areas, including slopes and other rugged terrain similar to that encountered in combat. Vertical envelopment tactics made it necessary to carry in up to 30 combat-equipped troops.

Lands Camed

Other loads consisted of a 75 man howitzer jeep and crew or a 235 man howitzer and crew. A "Mechanized Mule" or "Mighty Mule" armed with a 308-mm recoilless rifle and crew forced lands to return for further trials.

External lift conditions were studied with the cables carrying a 2,360 lb concrete block or a 900 gallon fuel cell weighing approximately 1,700 lb. The test is used to transport gasoline to a battlefield.

Navistar offices emphasize that the KH-15 program is not an evaluation test. Primary purpose is to demonstrate pilots and machines with the aircraft and its characteristics.

Flight simulators provide for a review of all standard operating procedures such as starting, testing, landing, single

capture performance and landing. In addition, there are numerous civil-type emergency procedures, rough-weather landings, instrument flight, cross-country and night flight.

Our Work Continues

From now until 1980, come face-to-face with our industry. MacDonnell Douglas has completed testing. The canceled Bell had one crew on duty with each aircraft, along with technical representatives and special experts in the fields of electrical systems, hydraulics and handbooks.

Conclusion

In a frontispiece strip on page 32 of Aviation Week's May 11 issue, it was understandably stated that Comsat, Dynetics Corp., announced "1 for 1" track split. Actually, the direction of the aerospace division to submit to share owners a recommendation to increase the authorized common stock from 35 million to 10 million shares.

General Dynamics was referred to as "holding company." It is an "operating company." It is the "operating company." The ship and sales doubled those of 1975, actually, sales increased 52%.

PRODUCTION

Titanium Displaces Steel in J57 Engine

By Irving Stone

Significant advantage of the J57-PW alloy is its reduced density. Sharp says it is about 5% lighter than the Ti-6Al-6V and Ti-14Mo-6V alloys and 25% lighter than G-1148M. Thus, for a given volume requirement the J57-PW alloy is at the lower weight. Sharp pointed out. *Continued*

Pratt and Whitney is specifying the alloy for blades, discs and face plates.

Bent Alloy

Apart from commercially pure titanium, which is being specified where forging and welding are required for parts subject to only moderate static loads, the main attraction is also for welded titanium applications (A-7110). The alloy is specified for cast pressure case applications in J57-PW high strength coupled with good weldability has definitely its attractions.

The J57 engine was originally designed with a steel compressor. Pratt will never use wing titanium in most models of the engine but has to use steel. Also, problems of corrosion of the steel compressor is a real one, Sharp said. "There are no known high strengths such that are truly corrosion resistant and the best non-titanium available are subject to serious damage by particles in the atmosphere. That even control panels can be corroded and then strength and performance impaired, he pointed out.

Compressor Materials

Titanium often have excellent corrosion resistance and the positive advantage will contribute to conversion of strategic materials such as aluminum and nickel. This should be a very positive advantage from the standpoint of engine development, Sharp said.

Numerous engines with titanium rotor parts of Ti-6A, 14Mo and Ti-14Mo titanium alloys have been produced and considerable flight time accumulated, Sharp revealed. Barefoot, Pratt and Whitney has gone into production with the newer J57-PW alloy. All of the company's experience and data that they represent the best technology available, an Alcoa titanium alloy, he said, he reflected.

The 6% aluminum is used elevated temperature strength up to 600°F and improved oxidation resistance on the last working temperature range, a factor which contributes to longer control of corrosion and ultimately to improved efficiency.

The 4% vanadium-gamma forming element provides strength and added resistance against instability under stress at elevated temperature.

of metal lots that occurs in cutting the lot and her rare cut blends.

Concerning the influences in the forging of the fast stage compressor disc, it was pointed out that the net weight for the disc forging has been reduced from about 125 lb to 75 lb conventional and from 110 lb to 60 lb weight of the finished disc forgings are 25% and utilization ratio (finished weight/parent weight) has gone from an original value of 0.33 to the present value of 0.36. Sharp declared. Figures he gave for the first disc were input weight 126 lb, finished weight 41.7 lb, which gives a utilization ratio of 3.35.

"In making the recent advances in forging titanium compressor discs we are competing with steel on a utilization basis," Sharp declared.

Compressor Blade Use

Use of titanium alloy as used for compressor blades in a "relaxed" Sharp said. The application takes advantage of the corrosion resistance and the low density of the material. Compressor blades made from titanium operate at lower ultrahigh stresses in service, demonstrated by measuring dynamic strains on steel and titanium compressor blades measured at adjacent sites in an axial flow compressor disc. Since the titanium blades develop a higher

Explosive Forming Eliminates Steps

Los Angeles—Gibson designs in high strength materials which naturally would be forged, now can be made in a single step process, according to Keith Wilkins, Lockheed design engineer. Wilkins outlined his method in a paper delivered to the Special Forming Techniques session at the 11th Wärtsilä Metals Congress here.

Cold explosive (or high velocity) forming, he presents alternative multiple operations involving in forging, replacing them with a single operation in which a precisely shaped charge shoves billets into shape.

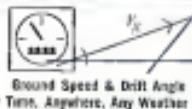
Using the explosive rods shock waves travel through the billet at very high velocities, creating a plasticity in the material. The shock wave is damped out as the shock wave passes through the material or in the plastic zone. By the time the shock wave reaches the surface, the forming has taken place.

Advantages of the system: Wilkins said, include:

- Reduced number of machining steps.
- Quality production of working parts at close tolerances.
- Irridate shapes made from hard materials at close temperature without heat treat.

Two examples of explosive forming, Wilkins listed were forming of a cup 4 in. deep, 2 in. diameter, from a 16 in. diameter billet of 10.8, and a 2024 alloy which was made into a cup such as diameter which was expanded to 2 in. diameter ratio.

Second use of explosive softening by Wilkins was in sheet working. The example given was profile rolling of class aluminum billets as hard material. Normal rolling or pinching resulted in high dull and poor surface prior to roll. Instead, a modified impact was used, driven by explosive charge, which produced the desired holes and was capable of extrusion and further enlargement.



One look with the pilot's KMGWTS in a plane, his radio tuned around him, and there's magic. The angle of attack, the angle of sideslip, is displayed on the static panel automatically and continuously.

The data read the key out in GPS coordinates, and the computer does the rest.

Other planes need similar systems. Other planes

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KAISER ALUMINUM EXTRUSION ADDS



This drawing Kaiser Aluminum offers customers with the North American Super Sabre's internal structure is included. One of Kaiser Aluminum's two large 800-ton presses made this extra-large extrusion possible.



Finished spar after machining is strong enough to double as a primary budget girder, light enough to be lifted by one man, and it matches to the tolerance of an expensive weld.

SUPER STRENGTH TO SUPER SABRE

AND CUTS WING SPAR COSTS

From the moment the Super Sabre's designers first decided on the weight and strength characteristics necessary for the front wing spar, the engineering, manufacturing and purchasing coordination at North American Aviation began clicking.

After extensive cost analysis of the new material, parts, labor and tooling, North American's engineering specialists recommended that the wing spar be made in three sections — two aluminum extrusions connected at the center by an aluminum forging.

Strength Without Stress

Because the extrusions were undergo special machining, and must remain flat and free of warps after machining, it became evident that *strength* rather than *extrusion* would make the job easier and less costly.

North American purchasing personnel, working closely with their metallurgists and engineers, chose Kaiser Aluminum extrusion for three very good reasons:

1. At Halethorpe, Maryland, Kaiser Aluminum has no 800-ton heavy press capable of making the extra-large extrusion required.
2. Kaiser Aluminum's equipment also includes a 750-ton press which stretches and levels large extrusions, thus relieving stress for the required machining.

3. Kaiser Aluminum's superior forging method eliminates impurities, air pockets and other weaknesses from the extrusion. Thus, Kaiser Aluminum alloy 7075-T6, used in these extrusions, is not only extra strong (tensile strength, 81,000 PSI), but also extra high in quality.

The use itself of North American's useful placing and low-cost aluminum's skilled manufacturing of the production of lightweight, high-strength F-100 spars at *an average cost for hollow cast products in the original cast analysis*.

Kaiser Aluminum now offers 3 major facilities as sheet extrusion corporations... a light and a heavy press plant at Halethorpe, Maryland, and a very light press facility in Duluth, Illinois.

For immediate information and assistance on extrusions, call the Kaiser Aluminum sales office listed in your phone directory. Kaiser Aluminum & Chemical Sales, Inc., General Sales Office, Palmolive Bldg., Chicago 11, Illinois; Extrusion Office, Kaiser Bldg., Oakland 12, California.

Kaiser Aluminum

See "THE KAISER ALUMINUM HOUSE," Alternate Territories, MIC Network. Consult your local TV listing.

is expected that a high endurance ratio will be obtained by replacing the outer solid ring with thin hot-welded container bags and the forged outer band and forged ring with sheet metal, which will be hot formed.

Giving an outstanding example of improved endurance of titanium rings used by a forging supplier in the development of the interturbine compressor case outer ring, these figures were given: Input weight of A110 forged ring was 316 lb. By using the thinner forgings (accepting the various contours of the finished part) which are then rolled into semi-circles and then hot-welded together, input weight has been reduced to 171 lb. In addition to this there will be a saving in weight lost in machining chips as the thinner case contains only



Electra Wing Box Completed

First completed major structural component of Lockheed Electra turboprop transport-fighter wing house removed from jig at the Lockheed plant at Burbank, Calif. It is ready for next step, drilling of holes for attachment of leading edge, being made by Tensar under subcontract. Assembly of the fuselage has begun and mating of the wings and fuselage is scheduled for August. First flight is scheduled for January. Electra will have a maximum takeoff loading, carrying its 115,000 cubic feet with full load toward the tail. Freight is built up with longspans, reseams and struts into quarter panels, which are then passed longitudinally in a master casting. P.D.

New York Subsidiary Planned by Bristol

Laudes-Bristol Aeroplane Company (U.S.A.) Inc., to be formed in New York as a subsidiary of the Bristol Aeroplane Co. Ltd., England, will concentrate sales and after-service.

The chairman of the new subsidiary will be Mr. George C. R. Baddeley, chairman of the parent company. Initially the president and chief controller will be Mr. Stanley Haggard who is vice-president of the Bristol Aeroplane (Westinghouse) Ltd., Canada and was formerly general manager of the company's Westinghouse factory. Later in the year Mr. Haggard will be succeeded by Mr. David E. Pashford, who is being released from his present appointment in Bristol's civil air traffic, Washington.



FOUR OPENINGS FOR FLIGHT TEST INSTRUMENTATION ENGINEERS

Electronic Development Instrumentation Engineers. To conceive, design, fabricate, evaluate and test intricate components and assemblies aimed at maximization of data acquisition and analysis. Requires Electronics or Physics degree plus one to four years experience in electronics design.

Instrumentation System Design Engineers. To develop and coordinate over-all instrumentation system designs and associated techniques for collecting data for any engineering field. Requires Engineering degree and one to four years related instrumentation experience.

Field Operations Instrumentation Engineers. To operate and add to an airborne data gathering and analyzing station containing cameras and magnetic tape playback equipment. Electronics or Physics degree plus one to four years electronics design or test experience.

Lead Instrumentation Project Engineers. To direct over-all instrumentation system designs for major aircraft series or model. Requirements degree and six years instrumentation experience.

To arrange for a personal interview, or for prompt reply on these or other openings, please contact:

C. H. Collier, Assistant Manager Operations Manager CHANCE VUGHT AIRCRAFT, P.O. Box 5981, Dallas, Tex.	Allocated report personal interview
I am interested in _____	
On the opening for _____	
Name _____ Address _____	
City and State _____ Zip _____	



Soot Solved This Problem

One thing Richard (Ruck) MacDonald could say for flight and instrumentation — it had variety. Here he was, in line of duty, hauling a coal oil lamp on the Mojave Desert.

Looking back, Ruck says that the whole Crusader instrumentation program had been a series of shifting oceans. He'd started by talking to different specialists, finding out the kinds of flight information they wanted. He learned a lot about loads, loads, amperages and fuses. These were the things Ruck's instrumentation would have to detect.

Designing and building the system took him in another direction. There was the airborne equipment — up to 32 miles of wiring and 600 pounds of black boxes for a single demonstration aircraft. Each sub-system was compartmentalized, breadboarded, checked out and packaged to fit key corners of the Crusader structure.

Taking shape at the same time was a mobile ground station — another project with which Ruck was associated. He brought flight test monitoring and data processing along to subsections that they'd never been before. At Vought's Mojave Desert test base, Ruck's equipment clicked. It speeded preparation for

the Crusader's dramatic operational debut — the Thompson Trophy-winning speed run.

There was one catch — a National Aeromarine Association rule which would limit aircraft altitude to 325 feet during the Trophy dash. A Boreas of Standards biplane would race with the pilot, as stylus sketching out exact altitude on a smoked cylinder. Far enough — but Vought's desert crew didn't have a workable way to measure duplicate cylinders for practice. And precise warm-up flights were essential.

That's why Ruck went hunting for a coal oil lamp. He found one in the store of a desert outfitter. Back on the base, the lamp was lighted and the wick turned up. It "sooted" the purpose perfectly.

Instrumentation means development adventure and variety at Chance Vought. Here, engineers of all specialties are creative and self-expanding in knowledge in one of the most advanced instrumentalities industries in the country.

**Complete
Aircraft
Testing
Facilities**



- ✓ QUALIFICATION TESTS
- ✓ EVALUATION TESTS
- ✓ PERFORMANCE TESTS
- ✓ ENVIRONMENTAL TESTS

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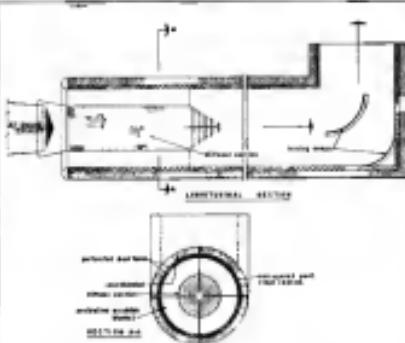
**AIRCRAFT
EQUIPMENT
TESTING
COMPANY**

1906-12 FLEET ST.
BALTIMORE 31, MD.
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500 Waller Bldg.
734 15th St., N.W.
Executive 3-5921

EQUIPMENT



MOBILE JET ENGINE nozzle shown positioned behind a Minco 38000cpi pilotless booster.



CROSS-SECTION and front schematic of Lommelius' model jet engine nozzle. Dimensions in inches.

Portable Jet Engine Muffler Designed for Carrier Service

as stationary devices and plants were moved or moved to the station, a time-consuming exercise.

The public's welfare was designed by C. W. Lennartsson, Inc., engineering consultants, and set up being built by Industrial Social Council Research.

During the discussions, Mr. Lawrence told Aviation Week that, while the designs were designed primarily for assault use, they could be used on land fields.

The main advantage of the mobile roadster is that they can be moved to the place on a wheeled carriage. Previous roadsters were so heavy that they are built in a fixed position on the body.

APPLIED POLYMER SYMPOSIA

THE MEASURE OF QUALITY



Aircraft Controls



Barber-Colman remote positioning system chosen for thermal control on Lockheed Medium

BARRIER-CALMANS
AERIAL 800 PPI-7



WHITE ACTIVATION

Aerospace Controls • Ballistic Components • Automatic Controls • Industrial Instruments • Air Distribution Products
Control Valves • Chemical and Processing • Medical Products • Metal Casting Tools • Specialty Tools • Double Block Valves

Dept. F., 1422 Rock Street, Rockford, Illinois

Dept. F., 1422 Park Street, Rockford, Illinois

Mobile stores used reductions found on
one with a 15,000 lb. engine in engine without
afterburner.

Frequency (cyclic)	Reduction (lb.)
71	30
110*	40
150	40
200	45
250	45
300	45
350	45
400	45
450	45
500	45
550	45
600	45
650	45
700	45
750	45
800	45
850	45
900	45
950	45

* Fixed columns of larger, solid-type sleeves
is about 25-30 lb. heavier at these higher
frequencies.

ster can be easily moved by a flight tag
or ground staff.

The new fighter is of somewhat
different design than their two in use,
according to Lennartsson. The shell
of the aircraft has been changed to
withstand the high velocities and tempera-
tures of current powerplants.

The delivery, in basket, in the center
of the fuselage will require changing
every 380,000 hours under normal op-
erating conditions. If used with an
afterburner-equipped engine, change
becomes weekly.

Lennartsson is designing a special
seated armchair for afterburner-equivaled jets without the use
of water-cooled. He is also working
on a slanted backrest for commercial jet aircraft.

Economy Crimps Douglas C-132

Douglas C-132 overwing freighter-transport designed at long haul, heavy cargo link its
extreme logistic plus of U.S. strategy and first stage of full-scale studies, marking
down low license of economy rate in USAF budget. These are no funds for it next year.
Block-up was built over two years ago. Payload of C-132 would be 100,000 lb. Total
range would be capable of three point probe and drogue refueling.



AIRLINE WEEK, April 1, 1967

Continuing Leadership

THROUGH
PERFORMANCE • VERSATILITY



Convair 840



Douglas



Boeing



Fairchild-Republic



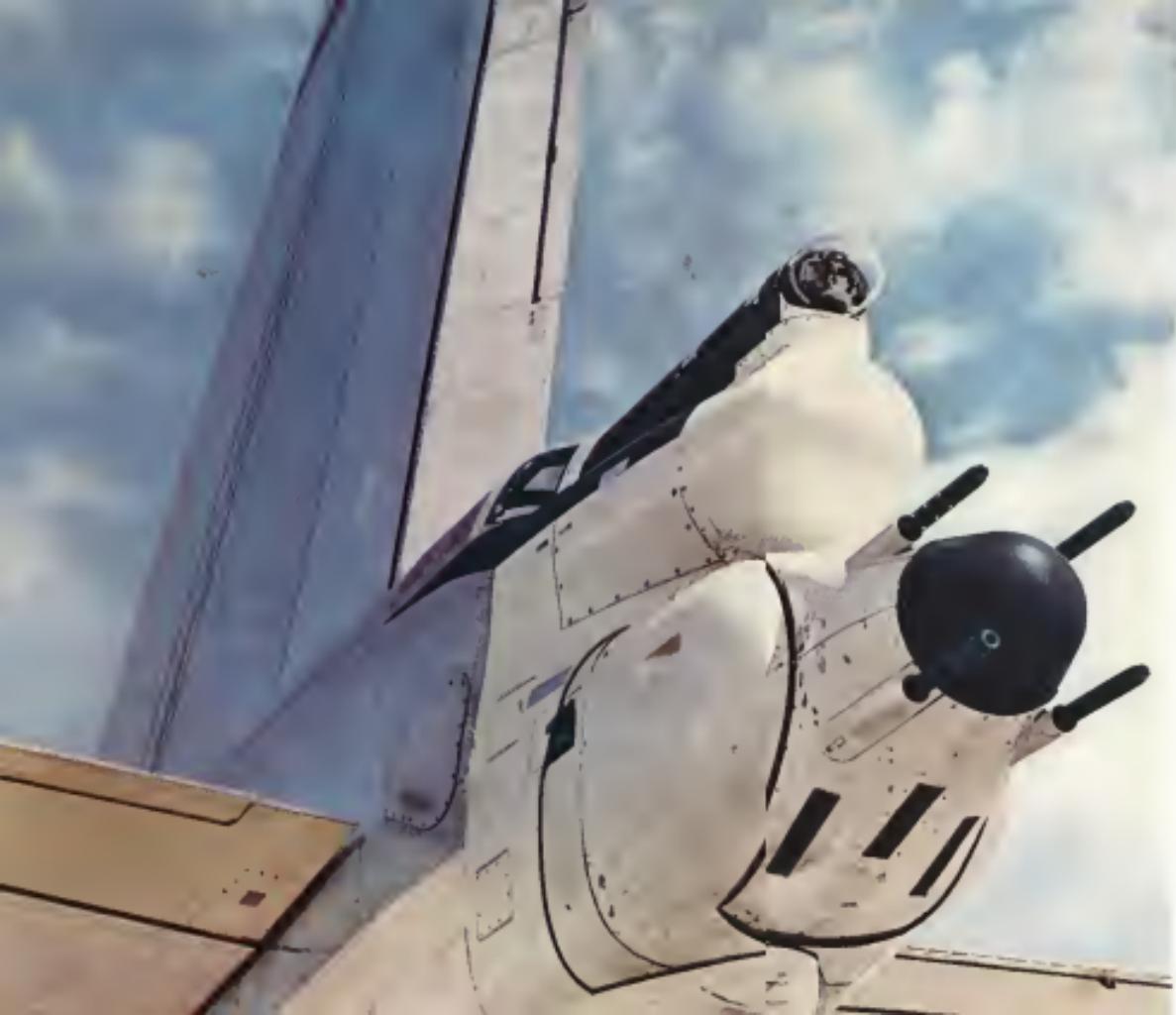
Lockheed

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HARDMAN TOOL & ENGINEERING CO. • 1645 S. Bundy Drive • Los Angeles 25, Calif.

SPECIFIED BY MORE THAN 60 MAJOR WORLD AIRLINES!





The fatal sting...

defending the B-52 intercontinental bomber is the Arma MD-9 fire control system that picks up, tracks, and with uncanny accuracy fires at its target.

Developed and produced by Arma, the MD-9 is just one of Arma's capabilities in advanced weapon systems.

If you have an advanced electronics systems requirement, or would like to work with a leading engineering team, contact ARMA . . . Garden City, N. Y.

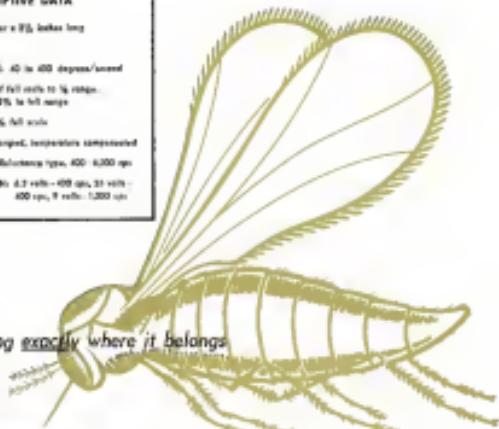
ARMA

A division of American Bosch Arma Corporation

DESCRIPTIVE DATA

- DIAM: 1 inch diameter x 7/8 inches long
- WEIGHT: 2.3 oz
- RATE RANGE: 40 to 400 degrees/second
- UNIQUITY: 0.1% of full scale to 10% R.P.M.
within 3% of full range
- RESOLUTION: 0.01% full scale
- DYNAMIC: Full stepped, temperature compensated
- FREQUENCY: Variable Reference type, 400-6,000 cps
- POWER REQUIREMENTS: 4.7 VDC - 400 cps, 33 VDC - 400 cps, 9 volts, 1,200 cps

Putting the sting exactly where it belongs.



GOLDEN GNAT

Miniature Rate Gyros for Missiles and Aircraft

Here is a precision, miniature rate gyro. It's tiny...measures only 1 inch in diameter and 2 1/4 inches in length. It's rugged...withstands 1,000 shock and 100 vibration to 2,000 cps. It has a record of proven performance.

Even under the most severe environmental conditions the Golden Gnat will perform as required. To make this possible every unique design detail has been incorporated. One such detail is the Gnat's gold plated steel housing for improved corrosion resistance and positive thermal sealing.

Wherever the need exists for high performance miniature rate gyros such as for angular stabilization in missiles and aircraft, antenna stabilization and for control applications, the Golden Gnat is surely suited. Write for Bulletin GN-1. Minneapolis-Honeywell, Boston Division, Dept. AWF, 1430 Soldiers Field Road, Boston 33, Mass.



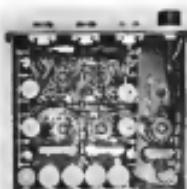
MINNEAPOLIS
Honeywell H
BOSTON DIVISION

caused from -65°F to -55°F. Since balance vibration in turboprop engines is high frequency and low displacement, it will have no remote effect on prop vibration which is low frequency relatively large displacement. (Editor's note: North American Marine Valve, Pasadena, Calif.)

The valves, which control the amount of fuel or to be mixed with oil to produce desired colors or torque temperatures, will be used on Douglas DC-9 jet transport and unguided military jets.

The valves are made for duct sizes ranging from 1 to 2½ in. in diameter. Advantage of the units is that they are considerably smaller and lighter than electric motor-driven valves now on the market, says Vapor Heating, which claims that they also weigh less than many comparable pneumatic valves. The 2 in. duct size shown is 10.5 in. wide by 11.5 in. high.

The valves are designed to operate at



New Prop Indicator Installed on KC-97s

A new propeller indicator indicator, designed to indicate engine displacement, rendering linear propeller vibration, will be installed on KC-97s and KC-97s made for racing. The device can monitor an overload 2,953,000 contract in Consolidated Electromechanics Corp. for the division.

The switch system will give instantaneous warning when engine vibration reaches predetermined levels during flight. However, the switch's cyclic monitoring vibration patterns are sensitive to turbulence and the switch severely exercised during take off or landing.

The system includes a means of periodically reading engine vibration levels for subsequent engine performance studies.

Consolidated Electromechanics also is developing similar systems for turboprop engines. The data base comprising engine components will be used except that the engine mounted pick-ups frequency range will be re-



Hydraulic Pump

This 3,000 psi hydraulic pump, which has a delivery rate of 15 gpm, and operates at 1,000 rpm, is supplied in Cessna's Superliner E-5 Hustler, one on each of the two engines. Pump's shaft can deliver 50 hp when operating at full speed of 4,000 rpm, supply power to the plane's steering, rudder, flaps, to raise and lower landing gear and to operate radio equipment. The unit is now being developed, tested for operation at 4,000'.

marion

ELECTRICAL
INDICATING
INSTRUMENTS



WHERE ELECTRONICS MEETS THE SKY

Marion Electrical Instrument Company
Minneapolis, Minnesota, New Jersey



**Miniature
Thermal Relays
Hermetically Sealed
in Glass**

99.99% PLUS RELIABILITY

**FIRING TIME...
0.1 SECOND**

*or any delay time
specified*

Minature units are hermetically sealed by our EXCLUSIVE method of bonding gold braids to glass housing. Relay data is based upon the "base hazard" principle and persons with little or no system design

**GUIDED MISSILES, ROCKETS
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TYPICAL CHARACTERISTICS

TEMPERATURE: -100°F to +450°F
VIBRATION: 30-2000 CPS
SHOCK: 300 G's

Another example of the ONE and ONLY process of bonding metal to glass for better, more efficient hermetically sealed electrode components.

WHAT ARE YOUR REQUIREMENTS?
Write TODAY for samples and detailed information on how these Relays fit your specific needs

EXACT SIZE

NETWORKS ELECTRONIC CORPORATION

14806 OXNARD STREET, VAN NUYS, CALIFORNIA

GENERAL DESIGNERS FOR ANSWER REQUIREMENT IN QUASI-WAVED ARMISTERS AND MINIATIVE RELAYS FOR ALL PURPOSES



The modulated type operates at 400 cycle 125° F ac. Both assemblies are actuated by electrical signals from with temperature control in resistance pads or Vapor Firing means contact thermistors.

The two units meet the latest military specifications, according to the manufacturer. Address Dept. 29, 37 90 E. Jackson Blvd., Chicago 4, Ill.

OFF THE LINE

E554 **Electron Precise Control** series will be used as standard equipment on the Lockheed F-27 Friendship aircraft. The cockpit equipment includes the Shrike Division of Lockheed Space & Airplane Corp., staff makers of other precision control equipment. Features of the Lockheed precise control system is its ability to monitor and control cabin pressure with great precision.

Hudson Tool & Engineering Co. is expanding its operations with plans to move its plant to a separate division. Features of the present plant include production of items which will allow the firm to take advantage of economies of scale. Models in 1957 configurations on a short-notice basis at nominal cost

Company says that over 10,000 of its units are now flying on more than 60 major airfields throughout the world.

A \$140,000 contract for new scientific equipment was awarded to General Electric Scientific Service Co. by USAF to be used on B-47 jet bombers. The new model Houseline Control, is made of a hollow, resilient metal form containing gas under pressure. Good up to 1,000°, the device will be used to replace solid-state seals on B-47 aircraft connectors. Shows considerable maintenance time and cost, according to the company. Seal can be replaced without use of heat and are reusable. Address: 39 E. Eleventh Ave., Valley Stream, N.Y.

Rail maintenance is the finalizing newest project in defense operations of the newly installed Washington telescopic approach lighting system installed at Washington International Airport. Company has made systems installed at New York International Airport (AW Jan. 22, 1958, p. 91) Newark Airport and Dulles Air Force Base.

Royal Saudi Air Force is acquiring six more, expensive yet lighter, Dc-3 Sab-



Test Facilities for Atlas

Steel platforms at mounting levels (left) are mounted at building where pressure test are made on fuel tanks at Convair's Afterburner Test Site (right) made out of steel and iron (background). Also standing on platform are Martin Roushman (left), chief engineer, and J. R. Drayton, manager, Convair Astronautics.

THE DART



Rocket-propelled SURFACE MISSILE gives wings to ground combat

The fast and powerful Dart is a rocket-propelled surface-to-surface missile designed for Army Defense by the Aerophysics Development Corporation, a subsidiary of Curtiss-Wright.

While its design and performance are classified, the Dart has been described as a simple but effective anti-tank missile—a single hit from which would probably destroy a heavily armored tank. The five-foot long, highly maneuverable missile has a solid-state-propellant rocket motor.

The Dart represents one of the Army's most advanced ground combat weapons. Another developed in the Curtiss-Wright propulsion family, it is typical of Curtiss-Wright's leadership in power to preserve peace.

AEROPHYSICS DEVELOPMENT CORPORATION
A SUBSIDIARY OF
CURTISS-WRIGHT
PROPULSION, SPACE, ELECTRONIC EQUIPMENT

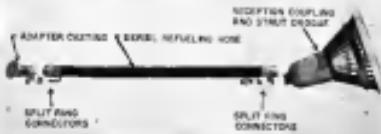
J15 Dartco, with Goodrich radarsets, men, wheels and brakes. Predictor plane, Serial J15. Lance is being retrofitted to the tailless fire. Goodyear Gascan Fabrics Albatross is supplying both radial tires.

Leia, Inc. will manufacture and sell surface engine temperature control equipment under U.S. patent rights assigned to Simmonds Aerocessories.

Ind. by British firm, Ultra Electric, Ltd. The hortook, newly used in Beriev planes, vents fuel flow to assure best turbine speed and temperature under all operating conditions. Lau also announced that it has been recently awarded a contract for approximately \$1-million to Air Materiel Command for flight control systems, guns and various special tools for the Boeing KC-135 jet tanker.



NORTH AMERICAN F-100 refueled by KC-135 with boom equipped with drogue adaptors.



STRUTS in drogue on boomer boom adapter provide improved stability.

Adapter Converts Boom to Drogue

Aerial refueling adapter for quickly converting boom to drogue. Similar to existing boom aircraft equipped with the probe-droge system, has been developed jointly by Sikorsky Tool Mfg. Co., San Carlos, Calif., and Wright Air Development Center.

The new adapter would enable compatible the boom refueling systems of the KC-97 and the forthcoming KC-135 jet tankers with such Air Force fighters as the F-100, F-101 and F-105, and Navy aircraft.

These heavier aircraft would need no conversion to use the boom. The installation has been successfully

flight-tested on aerial refueling trials involving the F-100 and KC-97 tanker at Wright-Patterson AFB, but because in place, the device is in production but not yet been made.

About four feet long overall with its connector, boom and drogue, the adapter is quickly fitted to the boom after removal of necessary boom end. During flight the boom and connection are made with the receiver's probe to aerial aircraft.

Drogue is composed of struts instead of a solid flat sheet, for better aerodynamic stability during boom

PROVEN beyond QUESTION

AMPHIBIOUS FLOATS

Nearly one hundred sets of Edu Amphibious Floats are in daily use around the world, piling up proof of their stamina, providing their owners with unusual utility.

On rough gravel strips north of the Arctic Circle, in scheduled airline operations in the Northwest, speed and drilling operations in Louisiana and South America...aircraft with Edu Amphibious Floats are proving beyond question the advantages and the dependability of Edu's thoroughly proven amphibious gear.



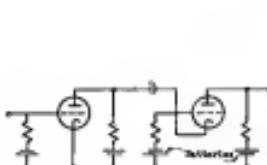
Edu Amphibious Floats are approved for the Cessna 180, 182, 185, 188, 190 and 195 and with a slight modification in height and performance can be equipped by increase utility. Other approvals are pending.



Why not investigate how the ability to land on land or water will increase the utility or revenue possibilities of flight operations? Send the Edu float brochure.

Edu CORPORATION
College Point, L.I., N.Y.
Akron, Ohio 44325

AVIONICS



SOLID-STATE CIRCUIT, including halogen power supply (left), which performs function of two-stage vacuum tube amplifier (right), a single-stage approach to audio-amplification. Simplest solid-state circuit could fit at most the size of present transistor.

Solid-State Research Brews Upheaval

By Philip J. Klass

New York—Researchers at leading universities and the state of the electronics art, spurred by the economic demands of guided missiles, space vehicles and high-speed air craft, have the ownership name of "micro-minimization," and is made possible by basic new knowledge coming out of research in semiconductor materials.

Micro miniaturization could denture the traditional laws of electronics that has separated civilian equipment from military from component suppliers.

"With micro-miniaturization, the basic techniques and equipment we

are used to power the first look at the moon's surface through scientific instruments recorded in a space ship for smaller, simpler, and cheaper than required to accommodate a 'big one now,'" John R. Moore told the IRE. Moore is general manager of National Semiconductor Laboratories.

These same ideas of the prospects of miniaturization were expressed during the recent meeting of the Radio Engineers' concentration here in the first IEEE seminar over several days recently in the subject of micro-electronics research.

"With micro-miniaturization,

What Is Micro-Miniaturization?

Micro-miniaturization is more than a mere shrinking of existing equipment size and weight by several orders of magnitude over present subminiature techniques. It is a potential technological breakthrough in the electronics art which is causing in the minds of industry new types of components and techniques coming from research in electronic phenomena.

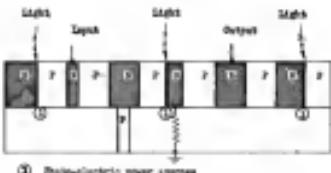
The technique, which mounted a major upheaval in the electronic art in less than 10 years, was first the first of a host of new types of subminiature components which will open new horizons for the civilian circuit designer and present communications technology advances. The new Micro or Vezoject, a super-sensitive solid-state microwave amplifier which promises to increase sensitivity of radio and satellite communications by a factor of 1,000 (10 db) (IARW Feb. 25, p. 87) is a more recent example.

"The theoretical synthesis of an improved compound, the technology of its use, and the discovery of a new useful effect in their materials can now do more to revolutionize the performance of an electronic circuit than can all the sheer ingenuity of the circuit designer," according to E. W. Hirsch of Radio Corporation of America's Princeton Research Laboratories. "The broad ranging output of circuit and device, which started with microwave tubes, is now found in more and more applications at frequencies ranging to 100 GHz."

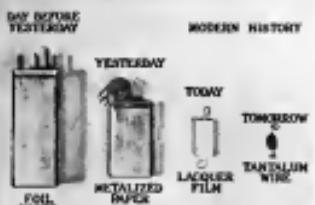
The great importance of subminiature phenomena and devices to circuit designers, and the need to develop the latest in fields of reliable new developments in the field is evidenced by a symposium on The Role of Solid State Phenomena in Electronic Circuits to be held in New York City April 21-23. The symposium is sponsored by the Federation Institute of Brooklyn, Institute of Radio Engineers, Air Force Office of Scientific Research, Office of Naval Research, and the Signal Corps Engineering Laboratories.

AVIATION WEEK, April 6, 1957

THE SOLID-STATE LIGHTING MATERIALS



CAPACITORS



NEW TECHNIQUE and materials have speeded door to major reductions in size of conventional components such as capacitors, resistors

diminished by light, could provide the power required for circuit operation. These solid junctions, based on the direction of high resistivity, function in resistance and connection that make no contribution to the electrical performance of the circuit and introduce a source of unreliability, Bonsuetti pointed out.

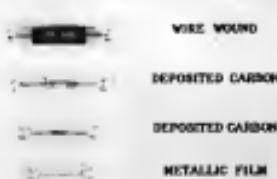
Size Reduction

Significant size and weight reduction could be achieved, Bonsuetti suggested by developing techniques for making a complete semiconductor circuit by growing or fabricating a complex series of semiconductor crystals capable of performing the function of transistors, rectifiers, resistors, capacitors and power supply.

"Carrying out his suggestion a step further, we can consider combinations of germanium diodes, ferromagnetic and other types of organic and inorganic materials deposited epitactically in columns of a thousandths of an inch are accepted," Bonsuetti said.

Bonsuetti recognises that considerable research remains to be done before such solid-state circuitry becomes an operational reality. For example, techniques must be developed to eliminate oxygenated impurities. (See sidebar, p. 10.) "Three of the junctions when

PRECISION RESISTORS



temperature, and for material aging, he said.

Support for the feasibility of Dr. Bonsuetti's concept of solid-state circuitry came from another IRE speaker, Henry A. Stone, Jr., of Bell Telephone Lab.

Energy Storage

It is well known that there is a large storage in semiconductors junctions, and probably has been known that a large voltage is required to reverse this energy storage in a semiconductor junction. But this voltage is dependent on high temperatures per unit area and with a very high "D" factor. He admitted that there were problems yet to be solved before semi-conductor junction capacitors could compete on a general basis with the present day capacitors, but added that the type does already is being considered for use in certain applications.

The problem of growing complete solid-state circuits was suggested several years ago by General Mills' Dr. Walter A. G. Baker, and Air Force Cambridge Research Center has been

INDUCTORS



NEW COMPONENTS, such as ferrite core and diodes, point up future problems of handling micro-miniaturized designs.

AVIATION WEEK, April 6, 1957

PRECISION CAPACITORS



NEW TECHNIQUES for applying coating materials to plastic component parts.

expanding the possibilities of such methods.

Initial progress toward solid-state capacitors was made by using conventional wire-winding, class 2 insulation, and available to multi-layered tubes. Dr. Malcolm Webb of General Electric's Research Laboratory suggested recently devices incorporating several restraining practices is one such possibility. Webb said:

"GE recently has developed a dual-mode transmitter, consisting of an N-P-N-P-N element which performs the function of two conventional units. The device is called a 'transistor' transmitter."

Fresh Approach

The development of new materials often selects new approaches to circuit miniaturization, but "often it is not so much new materials that we need as it is ingenuity in the use of the old," Stone told the IEEE.

Stone cited the history of paper capacitors where no reduction was initially achieved by reducing the thickness of the paper. After some initial research, he had noted a material which further reduction would have been too weak, eventually leading to breaking and cracking. At this point the ingenuity was solved by dissolving the resist film and covering the paper with a thin film of metal, providing further resistance.

The advent of insulation caused the need for still smaller, low-voltage components.

The lower working voltage would have permitted using thicker paper, but this was responsible for strength reasons.

Engineers have recently provided a solution to this problem. The paper is first coated with a polyimide film, then with an insulating lacquer, then with metallized film. The resulting lacquer and metallized film are then stripped off and used for making the capacitor while the paper coated with polyimide lacquer is discarded. The

lacquer film provides the necessary dielectric and structural qualities and can be made as thicknesses of only 0.0001 in., about one-tenth the thickness of the previous dielectric paper, Stone indicated.

New Capacitor, Revision

Stone cited the following new types of capacitor which hold promise of major size and weight reduction:

- **Lacquer film type.** For high quality, high voltage applications, thickness is polyimide film less than 0.2 mil thick for long usage, max as a dielectric. The insulation value is about 1.3X that of an equivalent metalized capacitor. Stone said:

+ **Teflonized wire type,** which substantiates the fact that selected materials offer reliability and (2) can already compete with paper in plate. The maximum length of the coil is limited by the length of the tube.

Stone showed a new metallic film capacitor, consisting of a glass fiber metal foil with chloroform and protected by a glass tube, which measures only 0.003 in. in diameter. However, Stone said that "Unusual choices for temperature and packaging restricts us, however, to a little value in circuit measurements to that date."

In addition, a microelectrode technique will soon make it possible to learn as an independent company," Stone and As. As the result of interest shown on improving printed circuit characteristics, some thought is being given to metal films which would be deposited directly on a printed circuit board. Such research would add no more volume to my report than "the letters on a printed page," according to Stone.

Hansen Hands Too Big

The big announcement didn't really achieve by reducing the thickness of the paper. After some initial research, he had noted a material which further reduction would have been too weak, eventually leading to breaking and cracking. At this point the ingenuity was solved by dissolving the resist film and covering the paper with a thin film of metal, providing further resistance.

Engineering techniques must be developed for bonding and handling delicate components such as the magnetic cores, and bonding the coil leads to the cores themselves, and the entire assembly takes many times more space than that occupied by the working elements—the cores.

Engineering techniques must be developed for bonding and handling delicate components such as the magnetic cores, and bonding the coil leads to the cores themselves, and the entire assembly takes many times more space than that occupied by the working elements—the cores.

Another word approach is an assembly of 100 individual wire capacitors, complete with leads which, Stone said could be made with no more assembly bonding operations than required to

Aeroquip MAIN-LINE



The advertisement of your right says the "super gem." Fitting is developed, and it was created we want to show why we believe this is true.

Brown tubes assembly spaced around the fitting, were shifted at A through the conduct and through the hose inner tube. The new design bypassed the lip seal and maintained the fluid seal gas in the compression area of some severe leak. Subsequent proof tests, using 20 ft. of test, showed that areas under compression through length B would not open up to 1000 psi.



Here, holes were drilled at C, D and E in other staples to try to give the compression areas not to block the effectiveness of the lip seal. The three holes were then used to air or 500°F for a total of 100 hours. They were checked at 1000 psi.

All three 100 hour tests at 1000 psi did not fail. All three 100 hour tests at 1000 psi did not fail. All three 100 hour tests at 1000 psi did not fail.

These tests were conducted on the -8 size. Further tests on other sizes resulted as follows:

- 8 size: 100 hour test at 1000 psi did not fail. All three 100 hour tests at 1000 psi did not fail.
- 1/2" size: 100 hour test at 1000 psi did not fail.
- 1" size: 100 hour test at 1000 psi did not fail.
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AIRCRAFT COSTING MILLIONS . . .



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JETCAL ANALYZER

Two of the most important factors that affect jet engine life, efficiency, and safe operation are Engine Gas Temperature (EGT) and Cyclic Stress (RPM). Excessive heat will reduce "working" life in excess of 20% and low EGT materially reduces efficiency and thrust. Any of such conditions will make operation of the aircraft both costly and dangerous. The JETCAL Analyzer provides accurate survey of the EGT and (consequently) fuel economy, and reduces errors of flyaway.

The JETCAL ANALYZES JET ENGINES 10 WAYS:

- 1) The JETCAL Analyzes accurately up to 95% thermocouple circuit of an aircraft's engine system, for any thermocouple type, and any number of thermocouples, accurate to $\pm 1^\circ\text{C}$ at any temperature.
- 2) Checks integrated thermometry in the engine before flight in partial pressure and temperature within the nozzle.
- 3) Checks thermocouples within the nozzle.
- 4) Checks thermocouples and insulation within the engine.
- 5) Checks insulation within the engine.
- 6) Checks insulation within the engine.
- 7) Checks insulation within the engine.
- 8) Checks insulation within the engine.
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- 10) Checks EGT system with engine control.



Tests EGT System Accuracy to
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(readily, without removing the engine)

Tests RPM Accuracy to 10 RPM
to 10,000 RPM ($\pm 0.1\%$)

The JETCAL is the world's first "in the field" EGT and RPM test system. It can measure up to 100 EGT points simultaneously, and insulations which are not usually accessible. It can also measure up to 100 RPM points simultaneously, and insulation which is not usually accessible. It can also measure up to 100 RPM points simultaneously, and insulation which is not usually accessible.

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with a single capacitor (See photo, right). Different ratios of capacitors can be obtained by connecting one or more of the capacitors in series or parallel. The design of the circuit would have to be checked off.

Concerning the two problems Ben says and that in the components become smaller, better engineering techniques will become possible. "Resistive band will be used for conductance for frequency tests and automatic techniques will have to be developed. All measurement equipment will be produced by complete automatic means, learning techniques," Ben says pre-



TINY 100-disk capacitor demonstrates our approach to laborious and time-consuming micro-molded components.

Wafer Spacers

Despite the greatest opportunity for micro-molded components, it is to be found not in the basic electronic component elements, but in component and circuit packaging techniques. "Features which are crucial in logic components are because of first importance when space use reduction is attempted," Ben told the IEEE.

For example, in a standard foil-paper capacitor, 50% of the unit's volume is occupied by the lead wires (one lead and distance), while only 10% occupied by insulation, terminations, etc. Yet in the wafer method, we prefer the working portion of the unit

occupies only 33% of the total volume, and this figure is down to nearly 20% in the new micro-molded linear IC packages.

In a typical printed circuit assembly, the volume occupied by the bodies of the components themselves may constitute only a few percent of the total volume of the assembly, Ben says.

New Type Components

For many years the electronic engineer had only limited numbers of component types with which to design his circuit. But recent accommodation in much has provided him with some 100,000 IC transistors and diodes. And

many others are on the immediate horizon. These include voltage sensitive capacitors, solitons, control cells and many other non-linear components, Ben says.

The new devices, employed in micro-wave radio circuits in lead resistors, may be licensed for other uses such as motion, capacitors, and attenuators, Ben says. "By changing the amount of magnetic material added to a micro-conductor new uses may be found other than the conventional time-modulated applications, for example, in using these field sensors."

New Look

Recent achievements in semiconductor technology beats those of silicon. Ben says pointed out, citing the human eye as an example. To duplicate the visual discrimination function of the human eye and brain, an electronic engineer would require 60,000 times as much volume as the few cubic inches employed in the human body, Ben says.

This prompted him to suggest electronic engineers and scientists to take a more practical look at the basic objectives of electronic circuits, and to seek a better understanding of the processes by which nature accomplishes similar functions in the body and in the brain.

For example, Ben says challenged in

A little pull
in the right
place . . .



Almost 'Who's Who' Reports

A cross section of the Who's Who in the aircraft industry—including Douglas, Alitalia, Fairchild, Grumman, Martin, Republic, Canadian Ltd., Pratt and Whitney among a host of others—is reported to have reduced engine wiring time as much as 60%. This saving is effected by the use of the new Robinson Wire Twister, an improved model of the ones that have been service with the Army, Navy and Air force since 1945. Improvements include the exclusive new "no-pinch" design, which never needs to hard-to-reach areas, and changes a vice-like grip on the wire by pulling it into a self-tightening device.

In addition to the greatly increased engine wiring speed, users report improved shop safety—fewer skinned knuckles and lacerated fingers.

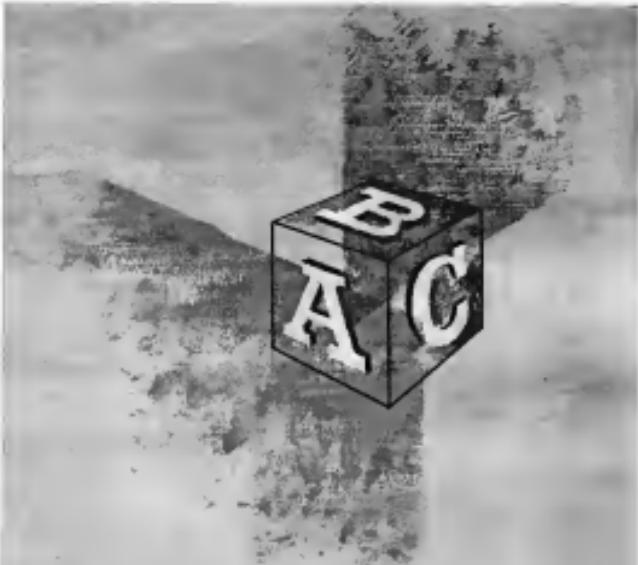
Besides their productive line improvements, Robinson Wire Twisters readily adapt to the shop to handle work on radio and radio equipment, on magnetos, starters, generators, and subassembly work of all kinds.

List price is \$18.50. Write for fully descriptive literature to Ralph C. Robinson Company, Dept. W, Box 3484, 2520 Crosby Way, North Sacramento 15, California.



. . . saves
% the usual
wiring costs





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AVNET/Avnet stocks many connectors. Not only Belden and Coaxial, but connectors made by 15 other manufacturers also. Avnet's two 3-story warehouses hold more than 4,250,000 connectors in modest warehouse, with the latest AM and/or JAM specs. Avnet delivers immediately any quantity of connectors. What makes buyers buy Avnet?

MENIXX/Avnet is already the established Factory Jumper for Belden Connectors and Honda Special Purpose Tubes. The new Belden Prejny Connectors are a dramatic improvement! Avionics and Electronics. They drastically reduce connector weight, take up much less space! Think of the advantages! Write Avnet for details.

CANNON/Cannon Connectors, Cannon appointed Avnet as Authorized Distributor Cannon Rock and Panel Connectors, both Standard and Miniature. Other major other types) make up most of the contributions ever made by connector engineers to the field of Avionics. Write Avnet for details. Cannon/Avnet. What a partnership!

Avnet

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Electric Connectors, Cannon Connectors, Wachowier Connectors, IPC, Belden Special Purpose Tubes, Sprague Connectors and Coupling, Wurthplexer Boxes and Tubes, Thordotek Transforms, OGI Connectors, JAM Sealines and Corval Sealants, Corval Cable Power, JAM Resistors and Potentiometers, Amphenol Corp. Connectors, Cor-Jones Plugs, Sockets, Stamps. What a source of supply!

AVNET'S TOTAL CONNECTOR STOCK IS NOW THE MOST COMPLETE TO BE FOUND! ANYWHERE!

goons to develop a system of "flow valve circuits" which can perform their desired information handling function without dissipating considerable amounts of heat. Unless this is done, auto-manufacturers will face even more severe equipment cooling problems, he warned.

Borch suggested that heat-generating components, like motors, might be cooled with a thermoelectric piston material that could convert waste heat into electricity that could be used elsewhere—possibly even for cooling purposes in cases of the Peltier effect [AV May 13, 1991, p. 31].

Although the most encouraging prospect for future developments appears to lie in the field of heat-generating components and circuits, NASA's Moore warned that similar efforts are needed for electro-mechanical devices such as gears, accelerometers, air data sensors and electric, telesteric and piezoelectric actuators.

Better Reliability

"It would be a mistake to look on auto-manufacturers only at size reduction—their solutions must meet new requirements, perhaps in extreme environments," Stoen told the IEEE. "Far-most among them is the improvement for dramatic gains of reliability."

Future rates of today's passive components can run from 1 in 10,000 to 1 in 180,000 per year, Stoen said. However, these low failure rates must be decreased by "orders of magnitude," he warned, not only for military equipment, but also for non-military systems.

The move to this goal, Stoen believed, is a higher order of control in the development of materials, including reducing weight of materials, control of cleanliness, and control of processes by automation.

Stoen predicted that it would be necessary to spell out quality control requirements of every stage of component manufacture in future military specifications, in addition to calling out the test conditions which the end product must meet.

This requirement for performance, together with the more rigorous environmental conditions, indicates that certain materials will be replaced by synthetic materials in component manufacture. Reasons is that little can be done to control inherent imperfections and variations in quality of natural materials, both of which can be closely controlled in man-made materials.

Such a situation, however, presents problems, Stoen said, and has not yet produced an improved body of knowledge that is useful in a variety of areas. Components, but it has developed new techniques for obtaining materials with very

ALL AMERICAN INGENUITY



Grumman Aircraft

A tight squeeze for safety

It is impossible to squeeze water for All American but developed a water "squeezing" principle to increase the safety of commercial jet transportation.

All American recently developed a device through a water-filled pipe has resulted in avoiding gear now in service with the Armed Forces.

New All American engineers have created the water "squeezing" principle not step father and have developed an emergency overheat device for commercial airports. Shipping jet transports in a few hundred feet in case of birds or reverse thrust failure, this new concept prevents loss of infinite-dollar aircraft and possible injury to passengers and crew.

All American's water "squeezing" principle makes the burner safe, economical and easy to operate.

Engines intended in carrying out "inoperable" often, the "squeezing" water, contact Bill Jones, Project Manager, All American Engineering Company, Box 2865, DuPont Airport, Wilmington 5, Delaware.



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Portable Tacan

Mobile TACAN ground navigation system (DN/TEN-5) is transportable by aircraft or truck. At desired location antenna is shifted into position (sheath) and lowered to ground. Antenna is then secured and unidirectional requirement power supply, or receiver and test equipment carried alongside (below). TACAN mobile package is manufactured by Craig Systems, Inc.



high degree of purity which should improve the quality and reliability of all components.

Fundamental research into new techniques for producing pure, dinner-size crystals for solid-state research holds the key to technological breakthroughs in the field of "solid-state" new electronic components and devices. Giff's Dr. Hahn recently observed, "Such research," Hahn said, "requires the combined efforts of several scientific disciplines, including physics, metallurgy and chemistry."

■ FILTER CENTER CIRCUITS

(The following items are based on papers delivered at the recent Institute of Radio Engineers convention in New York.—Ed.)

► **Digital Computer Optimizes Circuits**
—Use of high-speed digital computer to perform routine electronic circuit design work has to date been impractical. However, a simplified procedure was described by J. Ahern, F. Phipps and D. Wilson of Remington Rand, Utica, N.Y. Author is quoted as stating that computer has been used in solving "thousands of different circuits showing what types of outputs each will have and what minimums are permissible for components." The private designer is advised, though, that one operates with instant variation of component tolerances.

► **New Logical Circuits Use No Diodes**
—Spiral type of magnetic core logical circuit which eliminates need for diodes by using switching threshold property of square loop ferrite cores was described by L. A. Russell, International Business Machines Research Center, Rochester, N.Y. Representative models have been built using cores only 0.05 in. dia. x 0.01 in. high for maximum performance. Functionality, delay, saturation, "and, or, exclusive-or, "inhibition," "d, and only d," "not d, then," branching and controlled branching, Russell said.

► **Super-Speed Electronic Camera-Gyro**
—Using an electrostatic image converter tube, which can make photographs with exposure times ranging from 0.01 to 0.0001 sec, and a series of a magnetic coil with up to five exposures per second, exposure time on a single plate of film, was described by R. G. Marquette and R. W. Rutherford of Perkin-Elmer Technology, Inc., Lincoln, Calif.

► **Nuclear Power Supply For Avionics**
—Availability of radioisotopes in radioactive quantities and improvements in thermoelectric materials has opened the



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How to Meet Tougher Specifications for Shock and Vibration Protection in Jets and Missiles

You've got to design to tougher specifications for even-based shock and vibration isolators if you want to protect the reliability of electronic instruments in aircraft. Higher load ratings, higher rates, greater accelerations, no length increasing, and constant mass-inertia variability combine to impose shock and vibration loads far beyond current MIL specs. These severe operating conditions must be reduced in a predictable environment suitable for electronic equipment.

Isolator Requirements

Higher shock inputs require more stiffness in the isolator, to store more energy for a given deflection, so there will be less energy to dissipate if the isolator bottoms. Higher vibration amplitudes call for greater clearance and maximum mass-inertia at resonance. And vibration protection under dynamic acceleration demands a wide band of these characteristics.

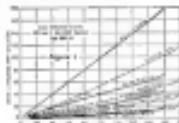


Figure 1 illustrates the importance of the MIL isolator that provides the performance characteristics shown by the curves, yet is dimensionally interchangeable with MIL-size isolators of comparable load ratings.

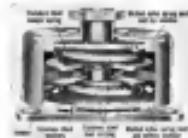


Figure 2

Addendum: Design Data

Other curves of isolator characteristics are available. For example, a chart for predictable environments or jet aircraft isolators are contained in Barry Figure 57-2. This bulletin fully describes the complete line of ALL-ANGULAR vibration isolators as specified MIL-STD-883. Write today for your free copy.



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say to small logistic static power packages which could generate electricity for remote and/or sustained nuclear-war facilities, James L. Briggs of the Basic & Development Center reported. Its permanent model under construction now has a 10-watt thermal source, radiating a 10-watt. Unit is expected to have a thermal efficiency of 60 to 70 percent.

► **Thermistor For Larger Televac**—Use of thermistor as series with vacuum tube heater circuit, to provide gradual application of heater voltage over three discrete thermal increments allows the use of a wide range of heater currents, as reported in a paper by J. J. Case and G. T. Staub of the Massachusetts Institute of Technology's Research Laboratory. Authors said that thermistor can reduce maximum initial heater current surge to 110% of steady-state value, whereas commonly used series resistor burns to only 100%.

► **Peristaltic Membrane Detector**—New type of microswitch detector, which makes use of magnetoresistive effects of a ferroic in a transverse field was described in a paper by D. Jaffe, J. G. Cachero, and N. Kornman of the Army's Defense Ordnance Test Laboratories, Washington, D. C. A barium titanate rod bonded to the ferroic contacts magnetoresistive motion acts as electrical output signal trigger based to the square of the magnetic power.

► **New Chromatograph Tube**—A 19-inch column by one-half inch, similar to the Corning Strength-Carbon Chromatograph which uses electrostatic deflection and two separate electron guns—one for FPD detector and the other for electron collection—was described in a paper by K. Schlesinger, B. Mignani, and J. F. Hoge of the 270th Research Division, Minneapolis, Minnesota. New tube reportedly gives high intensity display.

► **Light Amplifier Glass Report**—Improved photodiode materials and techniques have presented a 20-fold improvement in the sensitivity of pixel-type light amplifiers. Amplification as high as 1,000:1 is now possible with single-light-emitting diodes. B. Simon of Bell Telephone Laboratories told the IEEE.

► **Programmable Analog-to-Digital**—New analog configurations which provide accurate, constant, logarithmic over bandwidths of 10:1 or greater were described in papers by W. E. Rostek, R. H. Dallalard, and D. E. Irwin of the University of Illinois, Urbana, Ill. One of these is a variation of the familiar beam splitter, which requires the existence of elements to as



To engineers interested in entering the field of

INERTIAL GUIDANCE

E. V. Strain (left), head of the Inertial Guidance Department, discusses navigation systems mechanization with Inertial Guidance Scientist R. L. McKenna (center) and Senior Electronics Scientist D. G. Peterson.

Here is a field whose potential is equaled by the magnitude of its problems. The development of computers with extraordinary precision should offer unsearched scope for achievement.

At Lockheed's Research Center in Palo Alto, engineers and scientists are working on a number of different inertial guidance systems. They are involved in all phases of inertial guidance and navigation.

Their expanding activities have created new positions for those possessing backgrounds in:

- Mathematics
- Physics
- Electronics (such as magnetic amplifiers)
- Servomechanisms
- Flight Controls
- Precision mechanical and instrumentation development
- Special purpose computer design

Engineers and scientists possessing experience or keen interest in advanced applications of inertial guidance are invited to write

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standards of our present engineering staff. Our projects are too important and too complicated to trust to just engineers. What will you do at FICO? That depends on your specific abilities and experience. For details about the challenge, environment, and opportunity at FICO, write Philip E. McCaffrey at below address.

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- Analog Computers
- Velocity Sensors
- Frequency Oscillators
- Amplifiers and Transistor Amplifiers
- Networks
- Jewellers
- AC and DC Servo Motors
- Electronic Research
- Missile Control Systems

and near the final point. The rotating two voices in size, increasing with decreasing frequency, to provide eventual constant spectrum over a wide band of frequencies, it was reported.

► Realistic Radar Clutter Simulation

New device which can simulate radar clutter from several sources, among them atmospheric and man-made simulated targets, was described by J. Stiles of the Colorado University Electronics Research Laboratory, New York City. The device, developed under Air Force Cambridge Research Center sponsorship, generates a range of Rayleigh distributed clutter having radar bandwidths in range, but only echo bandwidths at constant range in a direction of time, Atkin said. The radio fluctuation rate of the video at constant range depicts the high coherence in real clutter; amplitude receiver using a number of successive sweeps, differentiating signals from ordinary noise.

► New Component Photo-conductors

Discussing new device whose capacitance changes with variation of incident radiation was described in paper by Frederick Gordon, Phillip A. Nissen, Jack Hansen and Howard S. Miller of the American Optical Corp., Optical Laboratory, Ft. Monmouth, N. J., and by Alexander Barnes of CBS Laboratories, New York City. Photo-conductors made with cadmium sulphide precipitate at high as 160% change in capacitance when illuminated by a 500-watt projection lamp, it was reported. New device also is sensitive to infrared radiation.

► New High Frequency Silicon Transistor

New silicon transistor with ultrahigh cut frequency above 25 mc sec and capable of operating at temperatures of 175°C, was described in paper by A. B. Phillips and A. M. Jantzen of General Electric, Syracuse, N. Y. New transistor is made by diffusion methods process which also provides design flexibility and good reproducibility, GJE said. When used in switching circuits, device has a current gain of less than 0.4 uncorrected and storage time of less than 0.1 microsecond, culture reported.

► Long-Drop Propagation

Results obtained between North and South America suggest that long-dash-ray propagation in the 16-40 mc band over distances of 6,000 to 8,000 km may result from two successive absorption reflections caused by "scattering" on the continents. This was reported by Dr. D. G. Villard, Jr. of the Stanford University Radio Propagation Laboratory in a paper coauthored by two associates, Silvny Stein and K. C. Yeh.

Expansions, Changes In Avionics Industry

Cohn Electronics, Inc., a name of newly formed corporation headed by LaMonte T. Cohn which will purchase other firms in the electronic field in the future, also president and chairman of the Board of Kaman, San Diego, is a part owner of American Technical, TWA, Convair and Northrop Aircraft.

Other recently announced events and expansion in the avionics industry include:

• Topp Industries, Inc., Los Angeles has formed new research and develop-

ment facility in San Diego for work in the semiconductor field. New facility, to be called TIKI-San Diego Lab, will be headed by Eric R. Corbin, Jr., former senior engineer of Bunker Ramo and Brown Insti-

tute College. It is currently occupied by Topp Industries.

• Sperry Rand Corp. will build new TWA II facilities near Brazil, Texas, to produce missile guidance and navigation equipment now being manufactured by its Tandem Instrument Co. division.

• Expansion is expected to be approximately 1,200. Sperry previously operated Navy missile facility at

Why are some Engineers more successful than others?

There are answers. But there are also many questions. Questions from people who work within or outside the industry. Questions from management, which believe in the importance of education, especially for the technical. Or questions from the employee, who wants to know what he can do to succeed.

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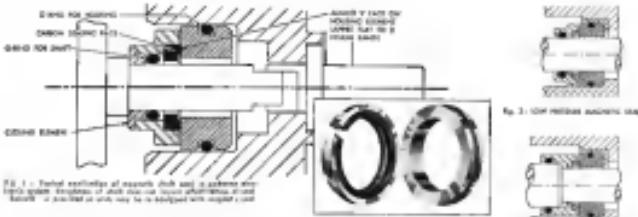


Fig. 1 - D-RING MAGNETIC SEAL

Shaft Sealing Problem in Airborne Electronic Gear Solved Through Magnetics

Effective, new magnetic shaft seal holds silicone lubricant in system under severe operating conditions.

By Edward A. Stevens
Manager, ASR Division

Since the early days of the space race, many new materials and fluids have found their way into aerospace systems. Among these are many of the silicones manufactured by the aluminum industry in military applications.

Consequently these hard-to-seal fluids must be sealed under adverse temperature and pressure conditions to keep or retain fluid shafts and bearings.

In addition, the customary factors of space and weight must be given full consideration.

By applying magnetism to this problem, designers have come up with an effective solution. The basic idea is to seal the shaft with a flexible ring and from the ring to install a conductive "wristband" permeated with steel wire. This ring assembly is held in place by magnetic attraction between the shaft element and bearing element of the ring. From this point on, the ring runs throughout the metal, as seen in view and cross, and the seal performs reliably for much longer periods than plain shaft seals and packed units.

Operating Principle

A magnetized ring of Alnico Y, with

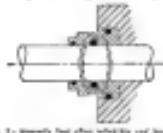


Fig. 2 - Magnetic seal after assembly and test in initial shaft sealing condition.

an O-ring position on its outer surface, is mounted on the shaft and a D-ring gear is mounted on the shaft and held firmly against the Alnico element by magnetic attraction. A silicon ring on the inner face of the shaft is held in place with silicon seating flange as assembled onto the shaft. An Alnico Y permeated magnetic bearing element with opposite pole to the Alnico Y of the seal provides the force to hold the shaft without element and bearing rotating simultaneously.

The O-ring prevents the enclosed fluid in the ring from escaping along the shaft. The O-ring on the magnetic element prevents the fluid from leaking out of the housing.

The prototype unit functioned effectively in keeping the silicone lubricant contained while preventing the entrance of water.

Production quantities of these seals were delivered on a rush schedule. In addition, first delivery was made on time and the first units are already already in operation in aircraft.

Specifications for Shaft Seal in Fig. 1

Detail No.	Detail	Detail
Detail 1	Shaft	3000
Detail 2	D-Ring	240
Detail 3	Temperature (°F.)	200
Detail 4		-50 to +200
Detail Reference No. 1	N	
Detail Reference No. 2	1040	

Standard Magnetic Seals Available

Standard magnetic shaft seals are available in seal heights or gaps at high or low pressure differentials across the seal shaft diameters up to 2 in. and shaft lengths up to 10 in. The pressure model 100 (P-10, 14), high pressure model 100 (P-10, 14), there is also a standard model, 100, for shafts over 2½ in.

Additional Technical Information Is Available

Send for complete brochure on magnetic shaft seals.

Magnetic Seal Corp., developed for Raytheon Manufacturing Co., a company which manufactures electronic equipment which involved the problems of a rough shaft with a sharp shoulder and a silicone lubricant that had passed every other type of seal

except magnetic.

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Anglo - Lewis is an aviator from fiction and AAA is a registered trademark of the course.

- **Angus Corp.**, Los Angeles maker of electronic switchgear, has added 15,000 sq ft to its previous facilities. Company reports orders for first four months were up 364% over last year and expects total yearly business to top \$12.5 million.

- **Tenns Instruments, Inc.**, has formed new British subsidiary, Tenn Instruments Ltd. to manufacture and sell semiconductor products in the United Kingdom. New £12,000 sq ft plant is now under construction at Bedford, 50 miles north of London.

More Business Flying, Curtis Predicts to IRE

New York City's present more business private aircraft will be operating in 1975 than today in contrast to a decrease in the number of military aircraft and essentially unchanged number of air career aircraft, roughly 1,200.

This prediction was made by the Fairchild's special assistant to aviation business planning, Edward J. Curtis, based on a study of existing data group. Curtis spoke last at the annual luncheon of the Institute of Radio Engineers Professional Group on Aerospace and Navigation Electronics (PGANE) and Professional Group on Military Electronics (PGME).

Curtis' aviation, currently operating 60,000 aircraft, will be up to 90,000 by 1975, Curtis said, adding the group has the potential of carrying 100,000 passengers. Air carriers are expected to handle anticipated increases in passengers without increased use of jets because of the use of larger, faster aircraft, Curtis said.

In 1975, Curtis predicted that 90% of the air carrier fleet would consist of turboprop or turbjet aircraft types, and that 18-25% of the present aircraft fleet will represent executive-type aircraft.

Curtis also said that market studies show that the Los Angeles area has by far the highest volume of hourly aircraft reservations—over 500, during peak hours compared with 145 for New York and 100 in Chicago. Although New York has a much higher level of scheduled airline activity, the Los Angeles area's much higher general aviation activity gives it the edge.

Curtis said that he is often surprised to find that an organization which has been preparing a project for years may not be able to "tickle off" the preceding adequate facilities for the future without major construction or an undesirable border of cost to either acquire them or the taxpayer."

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BUSINESS FLYING

Executive President Sales Tour Planned

By Ervin J. Bellon

New aviation and executive transport will shortly be exhibited to prospects by its British manufacturers, which expects to send a demonstration tour within the next few weeks.

Airliners in the Hunting Percival Executive President, a smaller version of the firm's Pembroke military crew transport aircraft, were exhibited in several countries in Europe and around NATO bases. Hunting Percival officials signed a contract with the West German Armed Forces for approximately \$6 million worth of Pembroke.

U. S. Tour Possible

Initial tour of the Executive President demonstrator will be through Europe and then the Middle East. The company is continuing winning the order book in the Middle East, and hopes to close it in the U.S. It estimates that it can deliver the Executive President as late July, to be followed later with interim and initial flights for 150,000 plus 15% duty.

Initial deliveries of the Executive President are scheduled to begin this autumn. Hunting Percival has told Aviation Week, The firm's plane is at Luton Airport, Bedfordshire, Eng. June 1.

Basically, a high-wing all-metal airplane with biplane landing gear, the Executive President is powered by two Avro Lycoming 321 series semi-turbine engines developing 1,600-140 bhp at sea level at 14,000 ft, 1,480-140 maximum continuous bhp at 8,000 ft, and 125 bhp each at minimum level cruise at 11,250 ft. Full-thrusting these blade-and-hub-character blades propel each aircraft at 140 mph, a useful range of 1,000 miles. Fuel tanks, located in the fuselage and wings, have a capacity of 1,000 gallons and are supercharged and use a single injection fuel system.

Normal seating for the Executive President is six passengers and a crew of one or two; a high-density version will seat up to 12 passengers. With the former arrangement and a baggage allowance of 44 lb per passenger, the plane has a maximum range of 1,600 miles at 140 mph with a maximum fuel weight of 205 gal. External fuel tanks, holding 50 gal each, may be added to extend total range to 1,940 mi.

Using Society of British Aircraft Constructors figures the Executive President's operating costs per acre



HUNTING PERCIVAL will be target in sales campaign by Hunting Percival for Executive President.

Hunting Percival Executive President

SPECIFICATIONS

Span	64 ft. 6 in.
Length	36 ft.
Height	10 ft.
Cruise Wing Area	480 sq. ft.
Fuel Capacity (Normal)	205.6 gal.
Oil Capacity	9.6 gal.
Electrical System	24 v.
Standard Empty Weight	6,058 lb.
Disposable Load	3,926 lb.
Normal Gross Weight	10,000 lb.
Maximum Gross Weight (With Auxiliary Tanks)	12,795 lb.
PERFORMANCE	
Takeoff (Hard Surface) Over 8 ft.	2,210 ft.
Cruising Flight Factor at Safety Speed (95% M.L.)	5,000 ft.
Minimum Rate of Climb at Max. Continuous Power	250 fpm.
Service Ceiling	20,000 ft.
Maximum Speed at 15,000 ft.	225.6 mph.
Cruise Speed at Max. Continuous Power at 6,000 ft.	211.8 mph.
Max. Estimated Cruise Range	1,600 miles.
Stat. Speed Press. of Gear and Flaps Down	79.9 mph.
Landing Distance One in.	1,215 ft.
Stall Drag Rate of Climb, Takeoff Power, Gear Up, Flaps at Takeoff, Prop feathered	210 fpm.

craft hour a range of 51/20 of the plane is flown 250 ft annually to 5% if exposed 150 hr.

Construction Details

The Executive President was constructed of aluminum. The fuselage is built in two sections, one part containing the cockpit and the other forward, with pressure cabin, glass cockpit, instrument panel and fuel tanks. In stain and bullet Cotes aluminum approaches 20 lb long to 4 ft. 6 in wide and is 6 ft high most of its length. Passager door measures 3 ft. 7 in. by 4 ft. 2 in.

In addition to the rear cabin luggage compartment, there is additional space in the nose measuring 3 ft. 0 in. for storage gear, including cedar millionaire.

Wings are built in two sections, folded in the fuselage at three points and are fitted with slotted flaps having three positions. A 14 deg. flap deflection is available at 80 deg. down, resulting in a lift coefficient of 1.0. Each wing has a flexible fuel cell of 63.6 gal. capacity situated in the engines and 79.2 gal. enclosed. Fuel is normally fed from a collector tank, supplied by each pair of wing tanks.



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Let there be a cross lead to prevent feeding both engines from either set of cells.

The two leading gear struts are mounted on a main fairing with two wheels. Landing struts fold into each gear module, which is a feature of the aeronavics system. Fins are shown closed when the gear is down. Main gear travel is 16 ft. 6 in. Each of the main fairings has a hydraulically operated break.

Dual controls are also extending through 150 deg. and are self-centering.

Wings and propellers are designed to take the Goodyear radial engine, which is fitted with Gavit tips.

Business Pilots Switch To Lightweight Hose

Recently a pilot was operating a twin engine aircraft in fact and off base by specifying an increasing number of field installations of Aerospay 601 light weight hose in their aircraft.

The engine base, which went on the market in 1974, originally was developed for military jet and new high performance piston engine aircraft to meet new requirements for high temperature, low pressure insulation.

The Aerospay 601 goes for the switch from standard aircraft installations to the difficult applications of their aircraft. Aerospay 601 provides a wide range of advantages for temperature measurement and control, fuel distribution, aircraft anti-icing and high pressure transients.

Sixteen reports from the field indicate that 601 hose has more than three times the service life of Aerospay 601. Civil Aviation Administration reports that 601 hose has been specified for installation to MIL-DTL-5511 and has greatly fitting blow-off resistance.

The equipment is a medium high pressure hose made of stainless Steel-N with flexible rubber reinforced and covered with stainless steel wire braid.

Total replacement of MIL-DTL-5511 hose with 601 equipment on a Cessna 180 light twin has been made on each Cessna 180 aircraft at All-Tech Aviation Sales, Inc., personnel of Southeast Avionics Corp. working with engineers from Aerospay Corp., Dallas, Texas. Since the installation, the engine has been run over 300 hr without trouble.

Southeast Avionics recommends that all installations of the 601 will be provided with Aerospay 604 isolators for sleeves. CAA has approved the installation, noting that test bore shows that this installation withstands exposure to 280°F for without leakage for 15 min compared to the original

specification for aluminum end caps for such equipment.

As installed on each Cessna 180, the component has been replaced one each 641094-01246 carburetor to tank nozzle line, 601036-6-0184, pump to carburetor, 601036-6-01234, isolator to pump, 601036-6-01235, tank to pump, 601036-6-0184, right engine intake line and 6111006-6-0184 pump to carburetor, 601036-6-0374, isolator to pump, 601036-6-0180, isolator to tank supply line, and 601036-6-0100, carburetor to tank return line.

On the plane's next visit, Southwest Aerospace will install 600 engine hoses on the oil pressure line with fuel cleaning using Aerospay coupling 180-60, a quick-disconnect which fits into engine caps.

Additional installations of the equipment have been made on Four-Cil Co.'s DC-1, which resulted in saving 20 lb weight over the previous installation.

Additional weight could have been saved had long hoses been replaced aft of the firewall.

Service and conversion centers which have gone to the Aerospay 601 installations include House Aircraft Service, San Antonio, Tex., and Aerospay, Inc., using the basic Aerospay 601. Super Viper conversion kits (under Super Viper) purchased separately are automated in changing power base to 601. Fox America Customer Overhaul, Inc., Brownsville, Tex., which chose the equipment for all installations forward of the firewalls on initial installation on an Alouette IIIC, and Executive Aircraft Services, Inc., Garland, Tex., which is using the hose on all of its major conversions.

LessCal Forecasts Sales of \$5.5 Million

Electrical equipment sales of some \$1.5 million to business aircraft were forecast for 1957 in LessCal Test Systems of West, Inc. This goal represents a sizable jump over 1956 sales of \$742,548 and shows an average after last year's drop from the 1955 house year when \$5,815,172 worth of equipment was delivered.

LessCal entered the 1956 after year with a team of awards to its top dealers, 25 of which are located throughout the United States and Canada. The company also honored 13 quota holders, making an unusual quota champion, Carl E. Beggs, Southeastern Skymen, Inc., St. Paul, Minn., who won 671.9% over his mark. Top distributor was Loran Hart of Aeromac Co., Long Beach, Calif., whose organization sold close to \$100,000 worth of Less equipment last year. Hartman, who took to Tom Mitchell, named LessCal's chief

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New Czech Helicopter, Lightplane

Show at a recent Czech air display were a new experimental two-place light helicopter (top photo), the HC 2, designed and built at the Aviation Research Centre; one Pegas RT-75 hp, six-cylinder engine at rear to power the open cockpit of 40 sq ft and seating of two. The aircraft is a development of the H-100, the first Mikrolight helicopter that was developed by a R&D by Walter Malenov, 400 ft. Top speed is given as 143 mph, cruising speed is 127 mph, and rate of climb is 570 fpm. Gross weight is 1,373 lb. Flying span is 12 ft, 16 in., and length is 13 ft, 7 in. The Mikrolight is scheduled to go into production this year and will be available for export.



rest of the year. Mitchell leads Repas Four with 19 distributors, north half of which achieved "Handed Gold" status.

Industrial product sales abroad went to Yingkang Aircraft, Inc., Wichita, Kan., for ADFA; Webster Aviation, East Alton, Ill., importers and Air-Cross, VHF equipment.

The top selling LenCo item in numbers of units and ADF-32, VHF-trans and -receivers, in that order, delivered the order in ADF-32, importers and VHF-trans.

Last report put approximately 15,000 ADF-32, 10,000 VHF-trans and 1,700 importers are currently installed in business and private aircraft.

Cessna 1956 Exports Hit All-Time High

An all-time high record of business and utility aircraft exports was set last year by Cessna Aircraft Co. In calendar 1956, 312 planes were exported valued at \$4,160,000 compared to 226 units worth \$2,875,000 the year before.

Business export sales were registered in Central and South America, which took 216 aircraft last year, according to Mr. McElroy, Cessna export sales man.

These included 17 Model 170s, 36 Model 175s, 60 Model 180s, 68

Model 185s, 14 Model 190s (these are also Model 195 agricultural versions of the L-19). Mexican purchases removed 75 airplanes, 35 went to Argentina and 25 to Chile. Other countries taking 15 planes from Cessna last year so far has yet to receive more of the 1956 order.

The company currently has 26 dealers and distributor in Central and South America. These are being kept to expand their facilities, because, "sales of business aircraft in this area have not reached even a fraction of the vast potential in view of the growth of the economy of our neighbors south of the border," according to McElroy.

Beech Lease Plans Build Big Sales

Within, Kao-France and, later, plan are adding to Beech Aircraft Corp.'s annual business plane volume. More than \$50 million in plane have been ordered by the company since inception of the program in the last two years.

Its finance rates are lower than second cut financing plans, the company points out.

Beech now has four total lease and finance plans available, the first was implemented only in December 1955 and three more were added last year. All are package plans with specially prepared financing of all costs involved.

A typical plan in financing plans to allow business plane users, particularly small company owners who can take it in without risking a heavy capital investment, to finance by Beech officials.

The company also has a plan for as distributors and dealers to enable them to finance depreciation. Sixty per cent of its domestic distributors have taken advantage of the plan, their purchases totaling nearly \$4.9 million.

Major Aerial Survey Of Baffinland To Start

A large aerial photo survey of some 40,000 sq mi of Baffinland, pricing survey flying, navigation and maintenance problems, will start early in May.

Project, to obtain large photo coverage for detailed mapping of the close hills, etc., will be headed by Photographic Survey Corp., Toronto, under contract from the Canadian government.

To carry scientific portioning of the photo material, a network of Skymon ground stations will be established by a joint firm, Field Aviation, Co. Ltd. According to the project director last summer, when over 100,000 sq mi of fuel were shipped from Montreal to the area base of the expedition at Frobisher

Inlet, north of Hudson Bay and about 2,800 mi north of Toronto.

FSC's fleet for the venture includes a Beech B-17, supported by a Cessna PBY amphibian, a DC-4 and a DC-8. The DC-4 will carry personnel and materials to Frobisher and the DC-8 will take them to eight Shores sites. Personnel at the camp will have a 10 work load supply. About 40 aircrew, ground station operators, technicians and operations personnel will staff the camp.

Another aircraft, Ercoupe, will be used at Shores, up to 20,000 ft. Average daytime temperatures at ground level in the area is a little above freezing, much of the locality being north of the treeline.

FSC and another associate, Aeromarine Surveys, Ltd., are currently carrying out more than a half dozen separate aerial surveys in Venezuela covering 25,000 sq mi. Most of the company's work is with the government and national forest to evaluate the country's oil and hydroelectric power potential. Lockheed Hudson, Lockheed 18 and Cessna PBY aircraft are being utilized.

Lightplanes Given To Argentine Clubs

Buenos Aires-Aeronautic Ministry gave 35 lightplanes of various types to standardized aviation associations and clubs.

The aircraft will become the legal property of the user seven after two years, in the meantime they will not be rented or sold to third parties.

Among the types distributed were Piper PA-31, PA-32 and 35 Cubs; El Dorado, Pacific, Wedi, Tandem, Waco Bee and Taylorcraft aircraft.



New Omni Converter

Nova VOA 1 aerial converter can be used with Novair Superline 101E or Superlite conversion system to receive television data. If the aircraft has a VOR unit, it provides a duplicate unit at low cost. This is a 53lb without dehumidifier, an off-the-shelf 51lb with VOA 1 display unit weight 12 lb, the conversion 1.5 lb.

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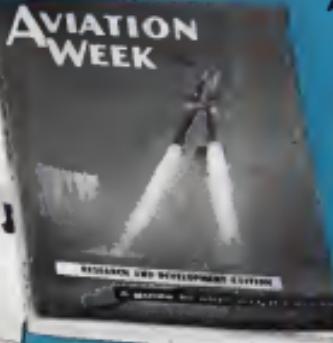
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RESEARCH AND DEVELOPMENT EDITION JUNE 3rd

A Guide to Airpower Progress



Need for Specialized Research and Development Information

Manufacturers are busy broadening their research and development activities. They recognize that their competitive position depends on the ability to compete in the urgent quest for new basic scientific knowledge in such diverse fields as aerophysics, aerothermodynamics, metallurgy, human factors and aerothermomechanics, etc. Because of the highly specialized sciences and technical fields concerned, manufacturers must often obtain research and development assistance from outside sources - government, university, scientific foundations, foreign and other manufacturers. In a sense, research and development has become a unique commodity that is produced, bought and sold.

Expansion of research and development procurement activities has brought the need for a Guide which will increase the understanding of procurement procedures and available facilities and capabilities. To satisfy this need, the Research and Development Edition, an outgrowth of editorial planning in this field as outlined later in this announcement, will provide the following specialized research and development information:

INDUSTRY

Industry's vital and rapidly increasing role in research and development will be surveyed.

Indexed guidebook section tells industry what

facilities and capabilities are available, where they are and how to utilize them. Information on the marketing of research and development availabilities will be reported.

Newly revised government research and development contracting policies and procedures explained in detail.

GOVERNMENT

Missions, organizations and operating procedures of National Advisory Committee for Aeronautics; Air Research and Development Command; and Office of Naval Research summarized. Their laboratories, research stations and test center facilities, capabilities and availabilities analyzed in detail.

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Corporation Pilots Plan Standard Minimum Training Requirements

New York—Development of standard minimum training requirements for business plane owners is planned by a group of corporate pilots working with Flight Safety Foundation here.

Need for such a manual is threefold, executive pilots feel:

- It will be of great value to small operators which have not established their own pilot guidance training programs and it should be very useful to corporations which begin to fly their own business planes.
- It will provide pilots, who realize the need for such regular checks with a means to compare certain selected management personnel that names and time should be spent in training to maintain safety.
- Such concerted action by business pilots they feel, will adduce to Civil Aviation Administration that corporate aircraft operators are taking action to establish definite standards for their industry.

A prime objective is to establish an on-the-job training guide for all business plane owners, regardless of the types of aircraft they are flying. Currently, Randy Carpenter, vice president of corporate aircraft operations in col laborating pilot proficiency check, amongst his many duties, is working on this manual.

Next step will be to sift through this and develop a common manual incorporating the best procedures

Among the subjects to be covered will be inspection of pilot checks, methods used and the extension of knowledge Methods used in outside agencies to check pilots will also be analyzed.

One of the difficulties facing some were corporate pilots in setting up such procedures for their own aircraft is that if they start to check other firms' methods they are likely to get as many different opinions as there are of the number of possible ways.

A survey of several large corporate plane operators points this up.

• Company A: Two hours Link or an equivalent sim, switch to an open course check with a CAA exam inspection twice yearly refresher at Flight Safety, Inc., at Chicago and once yearly a 7½ day check at Flight Safety, Inc., N.Y.; ground school training course. Piloted flights are used for crew refresher checks, each averaging one hour monthly while dual-checking.

• Company B: Pilots make two pre-flight ILB approaches monthly, one max, one LF range; checks and refresher courses are taken every three months.

• Company C: Two hours orientation check plus two hours instrument check each month; older pilots can have a results check is checked every six months and a written equipment test to twice or three times a year; refresher checks are taken every four days; dual check United Air Lines courses or company courses for two weeks and a



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Bullplayers Get Private Convair 440

Increasing shortage of reliable chartered planes prompted Brooklyn Bullpups to buy their own Convair 440 aircraft designed to take the major league baseball team around the country, and on their new team's way to the World Series. Douglas will place aircraft during low season, June 4 to October 1, Los Angeles, San Francisco.

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written report is issued, new replaceable parts are located in 600 ft and ready to replace for the first 100 hr.

***Company D:** Pilots checked every three months, with monthly check made over an month, route check is made over six months, tank check every three months.

The company does not favor on more detailed training; company pilots are free to use available aircraft for flying or practice.

PRIVATE LINES

Flight advisors, giving up to two hours advance notice of potentially interesting weather, are being used as required by Flight Advisory Weather Service Centers. Included will be data on temperature, thermodynamics, local, dust storms, icing and turbulence, also in remote areas of low ceiling, restricted visibility and strong gusty surface winds. ATCIS located within the area affected by the flight advisor, or within 200 mi of adjacent area will broadcast the advisory on remote and standard, those in

subsequent scheduled weather broadcasts until the route is reprinted or expires. As the new service is implemented, two-hour terminal forecasts will be eliminated by ATCIS stations.

Randall's Airport, Mahopac, N. Y., was purchased by Mr. and Mrs. Steve Boies and Wilson B. Terro, Jr., for appx. \$30,000. They plan to develop business and private plane operations there in addition to skydiving activity.

DC-3 landing gear down, developed by Research Workers, add 10 mpg to the emergency demonstrator. New in production, new down is built with the original materials. R.W. reports that the gear down decreases fuel consumption by 3.5 mpg.

Bush Business No. 5,000 has been delivered to Tulsa, Okla., Mahopac, Conn. Business entered large-scale production in 1947.

General Electric Co., Schenectady, N. Y., purchased a Convair 310 for use in its Flight Test Division.

316 purchased by USAF will have Air Craft Radio Corp. ADP II direction finding, replacing standard Low range radio and.

Problem of holding rates at high altitude was solved recently by Pilkington Mills using the company's Twin Beach as a flying laboratory. Test was for home fit of Navy personnel stations at high Plate with Operation Deep Freeze who complained that rates weren't using investigation showed range was 8,000 ft above and level. Pilkington crew baked a cake successfully at that altitude, and during the procedure (old) the talker spoke of flavor and one and two-thirds cups of coffee to recipe, baked at 400 deg.)

Directional antenna, weighing 1,100 lbs., was built at site since Twin Beach TV station using a Skysidy S-55.

Additions of pitch control to Mitchell Industrial Aerobus makes a three-axis autopilot fit light aircraft. Details of control to own Aerobus were given there complete and artificial horizon to the factory, Municipal Airport, Marion.



Inflatoplane Is Modified

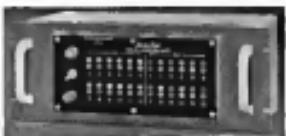
Latest model of Cessna's inflatable sailplane is equipped with enclosed cockpit and tricycle gear (AW Feb. 13, 1956, p. 10). Rapid 300 seats have been replaced by flying seats for ease of getting in and out. Prop and pusher prop has been replaced by tractor. Skin is made of additional fabric well saturated by vinyl threads. Called Inflatoplane, it was designed to test rubberized envelopes in structural members.

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Airborne "AutoRef" By providing constant-temperature reference of the thermocouple cold junction, this miniature unit now permits accurate temperature readings for all types of flight applications—including rockets and guided missiles. Its design meets these unusual airborne requirements. Light-weight—only 12 oz.; ruggedized; dimensions 3" x 3" x 3 1/2"; either self-contained with controls or with a separate control unit. A self-compensating bridge-type unit, the "AutoRef" permits the pre-selection of almost any desired reference temperature and can utilize almost any sensing voltage source. It is inherently compensated for any deviation from absolute.



Test Stand "AutoRef" The standard "AutoRef" is ideal for test cell work or data reduction systems where temperature and other D.C. signals must be recorded together. Cold-junction compensation for the thermocouple output is provided by remote, pre-determined temperatures in one, two, three, four, or five reference junctions. Desired reference temperature can be controlled to within ±1°F over a wide range of ambient temperatures. Designed for panel rack mounting, the "AutoRef" can be introduced anywhere in the thermocouple circuit. Available for off-standard calibrations. Capacities up to several hundred watts.

Write for Bulletin 81-C.

Thermo Electric Co., Inc.
SADDLE BROOK, NEW JERSEY
In Canada—THERMO ELECTRIC有限公司 Ltd., Toronto, Ontario

Wichita, Tex., to have pitch sensor added for 570B. Complete three-control unit comprising roll and derivative servo, pitch and yaw, and coupled with addles, costs \$1,195. Ordering instructions of owner's prop instruments. Coupling unit weighs 11 lb.

Mary Kay Co., Newton, Ia., maker of washing machines and other home appliances, added a Piper Apache banana plant to current Aero Commander line manufacturing operations at present no fewer than 1000 Air Commanders per month. Total plant cost \$2,000,000 and capacity 1000. The plant's original location has picked up entirely needed funds to begin production soon going.

Wingtip extensions and tip plates comprise new Republic RC-3 Seafair modifications that significantly increase rate of climb some 20%, shorten landing field distances 15% and 15% respectively and decrease stall speed at maximum gross weight by about ten miles/hour. New wing tip plates are moved and replaced with sections about 25 in. long extensions, increasing span by 16 in., tip plates measure about 25 in. vertically by 5 ft. in. long. No kits are being made available, since the modified parts are standard RC-3 spare sheet, but detailed plans can be obtained from Ned C. Root, 971 Silver Lane, E. Hartford 9, Conn. Modification is covered by CAA Supplemental Type Certificate SAI-11.

Ponca City Propellers, Ponca City, Okla., completed a 10-day specialized course on the Hawker Super-Victor business transport at San Antonio, Tex., to prepare the local hangar operators for servicing the burgeoning business transport. National Distillers Products, Inc., New York, recently took delivery of a Super Victor fitted with Bendix radio navigation equipment and Avco Avionics equipment. Space shuttle and Avco jet-Gravitron jets.

Bethel will manufacture a quantity of L-13A and L-12B transistored house planes to new L-12B configurations in flying supercharged Lycoming powerplants. Re-scaled aircraft will have same basic dimensions as original. Contract value amounts \$1.7 million, first effort Bethel's current production catalog for new L-12D.

Turbojet USA, pressurized autopilot producer is now 60 units monthly, and currently 15 distributor line has been raised to handle the equipment. Makar in Tustin, Cal., a division of Aerostar Products Co., Redwood City, Pa.

FSC Applied Research, Ltd., designer and builder of computers and aerial survey equipment, has been acquired

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TACAN unit shown with covers removed; plane is a composite model.

tube 78-page road map for jets

An 800-foot carrier may be as hard to find as a needle in a haystack, when the plane seeking it is at 30,000 feet and the time is 0000 hours.

To make the hunting plane a hunting program, we build the "ARM-21" TACAN equipment illustrated above. Its 75 tubes and associated components add up to a self-contained transmitter and

receiver, mapped in R/T/R/R resistance and accurate to pin-point tolerance.

The manufacture of equipment as important and complicated as this demands perfection, and nothing less. On the military as well as the home front, Stromberg-Carlson has long displayed the ability to take such problems in stride.



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Percival Farm Planes

Recent production Percival E.P. 9 agricultural aircraft at the company's Estate, England, plant. Sixty of the planes had been completed as of late last month. The company is basing one every nine weeks, hence the time the new aircraft is drawn from stores. Designed to carry a ton of fertilizer or five passengers and luggage, the E.P. 9 is also available on float or skis. Permitted by government as unrestricted general Certificate of Airworthiness for the plane, it is going to Australia soon on a sales demonstration tour. Another will be shown at the Farn Air Show May 24-June 2.

by A. V. Bee Canada, Ltd., from Hunting Aviation Group

Majority interest in Rotem, Ltd., Milton, Ontario, has been acquired by Canadian, Ltd., aviation and aerospace engineering firm. Rotem is a helicopter repair, overhaul, maintenance and on-gassing facility.

Aerial survey of 30,000 sq. mi. in Venezuela and Ecuadorian, Ecuador, will be handled by Foresi Air Services, Ltd., for the Directorate of Colonial Survey. Survey will be used in geological research and interpretation of cattle grazing areas. Foresi will start operations in April using a DC-3 with photographic capacity, complementing the job by end of July.

Admission of Australia to Canada is hindered by regulations, regulations, weather, navigation, aeronautics, parts of code for private aircraft writing to travel above the border. While Canadian Government Transport Bureau, Dept. of Northern Affairs and Natural Resources, Ottawa, Canada

Passage of first Massey MB-326 two-place jet trainer has been removed from its flightline.

Moyd Aviation, Inc., Del Monte, Ca., is new California distributor for 73 of the state's 99 counties. Presently Richard and Robert Lloyd purchased Moyd Aviation from George Hansen to form the new sales and service firm, which is being expanded to employ 14. The Lloyds' background includes lumber and construction businesses.

Aircraft Owners & Pilots Assn. is launching training of 45 flight instructors or 180deg. hour technique developed at University of Michigan to enable themselves safer from unexpected circumstances. University studies have revealed that the average non-instrument pilot can expect to live approximately three months after flying into an accident. The 45 instructors who will undergo training—one from each state—will be obligated to give the training to other instructors in their area.

Plans are being made to handle 10,000 visiting aircraft and 1,500,000 guests at Reading Aviation Shows' 8th Annual Maintenance & Operations meeting this weekend, and private pilots at Reading, Pa., Municipal Airport June 1. Total of \$6,000 in cash prizes will be awarded to 18 business and private planes in three categories and four weight classes.

Souney Mobil Oil Company of New York has taken delivery of a Hawker Super-Venture business transport fitted with RCA radio, Sperry autopilot and Collins communications and wings four seats.

Fairchild Aircraft, Ltd., England, ordered a fourth Westland Whirlwind (Sikorsky S-55) for industrial charter operation. FA now has two Whirlwinds working in Nigeria for Shell-B.P. Petrolium and Pecten Oil Co., operating in addition Whirlwinds to their own to supplement its current fleet there.



Supercharged Beech Joins the Army

First delivery of the new Beech 2,210-hp supercharged transport, military version of the EBO Twin Beech, has been made to the U.S. Army under a \$1.5 million production contract. First of the new Beech is its supercharged 340-hp Lycoming, providing a top speed of 210 mph. Army is already operating under contract the Twin Beech.



Valve Talk

FOR WM. R. WHITTAKER CO., LTD.
BY MARVIN MILES

C.A.A. regulations called for a heat test of 15 minutes at 2000 degrees F.

Whittaker subjected his new oil tank shutoff valve to 22 minutes under the searing flame—and it still operated perfectly.

With such performance, it was only natural that the unit would be chosen for both the Douglas DC-8 Jetliner and the Lockheed Electrajet Elecra.

Douglas engineers initiated the development. The company wanted something better than the standard steel valve that fitted externally to the bottom of oil tanks. For one thing, the standard unit was too heavy. For another, it could take 2000-degree heat for only a short time without losing its seat.

Whittaker's Mike Babich understood the job of working up a new design, a program conducted in close cooperation with Pan American power plant engineers on the DC-8.

The design took four months, with a series of changes and modifications involved, then the prototype was assembled and tested at Whittaker's test facility in El Cajon, Calif., as well as Douglas' and Lockheed's respective test facilities. Whittaker representatives were present throughout the development.

There will be two tank valves for each power package on the DC-8. And each of the four engines on the aircraft will have its own shutoff valve. This will be used on one aircraft; where a valve must be broken away from a line, Whittaker suggests using a three valve.

And speaking of aircraft valves for jet engines, Whittaker's Ed Elmer has come up with an unusual development—two valves for each engine. In existing units, Hart says, "the 100 Jumbo" and the Douglas Interceptor Group wanted something different, something lighter, more compact, and more reliable than present valves.

Various materials were considered, but the overwhelming problem of pressure compensation required most of them to fail at their first or second attempt to move. So Ed thought of coating aluminum with a special plastic that turned only a slight weight increase into a valve which, he says, "was proved to be highly resistant to corrosion."

To ensure that the protective coating completely covered the aluminum, Ed had to add extra material to the valve so there were two valves which could be individually crimped and then joined together by the metal collapse strength of steel.

Ironworks, the average valve manufacturer, has a valve with a 10-gauge wall that solves the problem. Ed thus provided a single (operative) valve with pressure compensation and a seat ring for the valve on the aluminum body. It will, he says, pay off.

Only the external parts of the valve, such as the pump covering to which the valve is bolted, can be made of steel and then heat-treated since the valve has repeated air testing—heat that affects the operation of the oil-valve-gate unit.

machinery and equipment, C.P.R. 10100
29-1115-010

Whitaker Aircraft Corp. Shady Grove, Md. 20886. Subsidiary of W.M.R. Whittaker Co., Ltd., to design, manufacture, construct and supply aircraft components and aircraft structures, aircraft equipment and aircraft equipment, C.P.R. 11100-11110-010

AT&T Maintenance Corp. Langley Research Center, Suite 100, 1200 NASA Pkwy. E., Hampton, Va. 23681-0000, 44-11100-11110-010

Boeing Research & Technology Co. 1000 West Seneca, Calif. Ind. several sectors of the electronic computing from RAY-TRAC, MA-2, 100-11100-11110-01000, PDR-1000 and QD-11100-11110-01000

Breath Aviation Corp. Disney-Central Park, N.Y. 100-11100-11110-01000

California Maritime Maritime Corp. 1010 Maritime Ave., N. W., D.C. 20001. Building maintenance systems, aircraft fueling, type AV-11100-11110-01000

General Motors Corp. AT&T Space Div., Dept. 1000, Mailbox 2000, 1000 N.W. 2nd Ave., Miami, Fla. 33136-0000

Grumman Aerospace Corp. 1000-11100-11110-01000

Lockheed Aircraft Corp. 1000-11100-11110-01000

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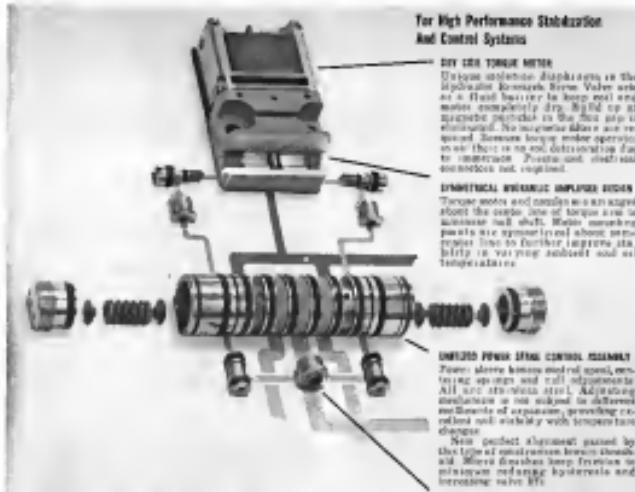
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The Hydraulics Research Dry Coil Servo Valve is available, quantity for high performance flight and control systems. Write for additional engineering information.



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SAFETY

CAB Accident Investigation Reports

C-82 Crashed on Emergency Go-Round

A Fairchild C-82A (Foster), N-4812V, owned by South Landing Corporation and operated by Stan Spratt, a subsidiary of Southern Airlines, Inc., was enroute in the MEM-LAT program under contract to government after having completed landing at Paine Field Airport, Renton, Wash., August 8, 1958, at approximately 0555Z.¹

The pilot, right, and three passenger-type passengers were fully dressed. The aircraft was damaged by ground impact and the ensuing fire.

Examination of both engines revealed no evidence of fire or flight. Removal of the left engine revealed that the left engine motor had been running. Oil inlet hoses and main bearing housing of the left engine were completely plugged with lead sludge.

The propeller blades of this engine and engine had substantial lead sludge which permitted continued rotation to extract the combustion chamber and cut through the exhaust ports. This condition caused all engines to run on the left side of the aircraft.

When the aircraft came to rest on the right side of the runway and examination of the right engine revealed no evidence of malfunction or structural failure.

The No. 2 propeller blade of this engine was bent and sheared at the root. Lead sludge was found in the engine, although negligible, was clearly visible. N-4812V made a right turn before impact to nose-in.

After passing over the city of Renton, Washington, about 0550Z, and passing north and west of Seattle, the aircraft turned down and to the west, although slightly, was clearly visible. N-4812V made a right turn before impact to nose-in.

After passing over the city of Seattle, Washington, about 0550Z, and passing north and west of Seattle, the aircraft turned down and to the west, although slightly, was clearly visible. The aircraft then immediately went into a climbing left turn. During this turn the aircraft stalled and crashed. The aircraft impacted immediately the impact point.

The U.S. Weather Bureau, 8219, as quoted upon in West Point Beach CII unit north of SeaTac, Wash., was 100 miles east of Seattle, Washington, at 0550Z, visibility 1 mile, temperature 58°, dewpoint 55°, wind 20 mph, pressure 30.02, density 35°, and 20°. Last update 2052, station on August 8, 1958, was at 0558, altitude 74 degrees less.

INVESTIGATION

The position of the wreckage was found to be 134°00' E. by 47°45' N. in the area of Renton, Washington, about 10 miles east of Seattle, about 10 miles west of the Puget Sound, 1 mile above sea level, elevation 300 feet above sea level, and 100 feet above ground level.

The first service operation sponsored by the U.S. Department of Commerce and the Federal Aviation Agency was conducted at the Seattle International Airport, Seattle, Washington, on August 10, 1958. All three external hydraulic line sections which had been found to have no pressure whatever were found to be in the "up" or inflated position.

Gross weight of the aircraft at the time of impact from Makes Field, Vicksburg, was approximately 13,736 pounds. The gross maximum allowable weight was computed to be 13,800 pounds.

Wing load attitude was a banking of approximately 130 degrees. It then rolled to the left and came to rest on a banking of approximately 120 degrees. The aircraft was found to be lower than 10 miles to the right, engine running a few seconds after the point of impact and the left engine going 62 RPM to the shutdown.

Examination of both engines revealed no evidence of fire or flight. Removal of the left engine revealed that the left engine motor had been running. Oil inlet hoses and main bearing housing of the left engine were completely plugged with lead sludge.

The propeller blades of this engine and engine had substantial lead sludge which permitted continued rotation to extract the combustion chamber and cut through the exhaust ports. This condition caused all engines to run on the left side of the aircraft. When the aircraft came to rest on the right side of the runway and examination of the right engine revealed no evidence of malfunction or structural failure.

The No. 2 propeller blade of this engine was bent and sheared at the root. Lead sludge was found in the engine, although negligible, was clearly visible. N-4812V made a right turn before impact to nose-in.

After passing over the city of Seattle, Washington, about 0550Z, and passing north and west of Seattle, the aircraft turned down and to the west, although slightly, was clearly visible. N-4812V made a right turn before impact to nose-in.

The aircraft impact and crash were examined for any evidence of atmospheric, parametric, seismic or constructive weak on the aircraft at the time of the accident.

With the exception of the engine alignment at N-4812V due to the impact of the propeller, the aircraft was found to be in approximately the same condition as it was before impact.

The aircraft impact and crash were examined for any evidence of atmospheric, parametric, seismic or constructive weak on the aircraft at the time of the accident.

During the investigation it was determined that there were no atmospheric, parametric, seismic or constructive weak on the aircraft at the time of the accident.

With the exception of the engine alignment at N-4812V due to the impact of the propeller, the aircraft was found to be in approximately level up to the surface but could not have been about 10 degrees to the left. He reported that he had been flying straight up about 10 degrees to the left up to the surface. When I observed him to be in a left climbing turn at a constant altitude, I asked him what he was doing. He responded that he was flying a left climbing turn. The elevator trim tab was deflected to the left during the turn.

The aircraft impact and crash were examined for any evidence of atmospheric, parametric, seismic or constructive weak on the aircraft at the time of the accident.

All aircraft movements of the landing gear and wing tips were found in the activated position. All landing gear were very near the ground at impact during powered descent. The aircraft impact and crash was found to be in a left climbing turn at a constant altitude. Approximately one-half the point where the aircraft impact and crash occurred, I observed the street to cut out over the top surface to the right.

Aircraft Specifications

An Fairchild C-82A, serial AN-BI-13, Bureau number 30-141, was assigned to the aircraft, specific flight data obtained did not allow it to be held below 120° until after it had been attained at 47,000 pounds or under. At a gross weight of 47,000 pounds or under the Federal Safety Act requires that the aircraft be flown with the following controls but the left rudder was set 45° to the right.

Investigations disclosed that the engine had operated approximately one-half an hour, steady as written United States, for seven or eight years and that the engine

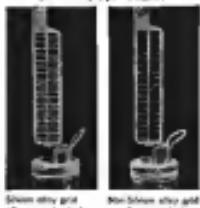


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Contact with the ground cause force a stall—over-the-top—while in flight, in addition to the possibility of a ground impact C-47. A collision of the aircraft with the ground because of a malfunctioning left engine and less suspended would be repeated if the pilot's use of low radio and thus increase the time that was "over-the-top" would result.

Although the landing gear was observed to have been in the extended position while the aircraft was approaching the impact, the maximum of the landing gear was also the maximum of the aircraft's weight at the time of impact. C-51 landing gear rates forty seconds, the average acceleration rate to be 12 seconds. This amount of time would allow the gear to be arrested during the last two wheels round approximately 1,000 feet.

FINDINGS

On the basis of all available evidence the Board feels that:

1. The aircraft and crew were normally certificated.
2. Weather was not a factor.
3. Gross weight of the aircraft and distribution of the load were properly distributed.
4. During approach to the impact surface malfunctioning of the left engine occurred.
5. An improperly planned left approach resulted in the aircraft's nose being lowered into a ground impact.
6. During the unanticipated ground impact the left engine was stalled and having failed resulting in loss of power on the left engine.
7. The pilot did not take advantage of the available controls.

8. The left side of left engine power was interrupted and the drag resulting from the unbroken left propeller resulted in loss of aircraft control.

9. Despite the remaining left turn, the aircraft was stalled and crashed as "best height" upon.

Possible Cause

The Board determines that the probable cause of the accident was the loss of power on the left engine and the drag resulting from the unbroken left propeller resulting in loss of directional control during an unexpected ground impact.

By the Civil Aerostatics Board:

George E. Dohle

Chairman

Warren D. Stearns

C. Joseph Shultz

SUPPLEMENTAL DATA

The Civil Aerostatics Board was unable to determine the cause of the accident at 0800, August 8, 1966. An investigation was immediately started in

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accordance with the provisions of Section 701 (1) (2) of the Civil Aviation Act of 1958, as so amended. Depositions were taken at Boca Raton, Florida, on September 5, 1958, at Miami, Florida, on September 6 and 7, 1958, and at Washington, D. C., on September 21, 1958.

Aircraft Operator

Six hours, the operating subsidiary of United Airlines, Inc., a seventh division California corporation maintaining its principal office with the parent company in Chicago, Illinois. United Alaska, Inc., has operated airplane mailing and flying service since 1948.

Pilot Charles W. Day, age 36, was employed by United Alaska Airlines, Inc., December 12, 1955. He held a commercial airplane pilot certificate with a C-45, DC-3, and C-46 rating under commercial privilege. He had a total of 8,978 flying hours of which 156 were on C-46 aircraft. His last planned continuation flight on September 20, 1958, was started at 0600 hours. The last instrument check was February 20, 1958, with check rates (CAA) and chart valid through January 31, 1958.

Captain Ross F. Healey, age 32, was employed by United Alaska Airlines, Inc., May 17, 1958. He held a commercial airplane single engine multi-engine rated, and instrument ratings. He had a total of 5,215 flying hours, of which 272 were on C-46 aircraft. His latest class II physical examination was passed on March 1, 1958, with no waiver.

The Aircraft

Fairchild model C-46A, N 4812W, serial number 44-133065, was manufactured in 1944 and registered to United Alaska. The aircraft was equipped with two Pratt and Whitney model R1830-81 engines. The rated hour and time since overhaul was 335 hours and 179 hours for the left and right engines, respectively. The gross weight was 10,000 pounds. The maximum takeoff weight was 12,240 pounds, of which 2,132 pounds was on the left and right propellers, respectively. Time since overhaul was 138 hours and 1,078 hours.

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These sensitive career positions are open for both senior and junior engineers. Knowledgeable, imaginative engineering trends are needed to solve the overall problems of reliability and economy under extreme environmental conditions.

Please send a resume of your education and experience to:

Mr. ROBERT A. WALLACE
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Radio Corporation of America
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Executive-Plant Sales Manager (approx. \$10,000-\$12,000) - 10 years experience in sales and exp. in plant sales. Must be experienced in selling to aircraft manufacturers. Good record of sales and profit. Excellent compensation package. Send detailed application to Mr. W. H. Johnson, Vice President.

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Plant Engineer - Design position involving plant layout, cost analysis, and plant modification for continuing manufacturing operations. 10-15 yrs. experience in plant layout, cost analysis, and plant modification. Good record of sales and profit. Excellent compensation package. Send detailed application to Mr. W. H. Johnson, Vice President.

ATE Test Equipment Sales Manager - 10 years experience in sales and exp. in plant sales. Must be experienced in selling to aircraft manufacturers. Good record of sales and profit. Excellent compensation package. Send detailed application to Mr. W. H. Johnson, Vice President.

Washington Office Manager or Representative - Must be experienced in sales and exp. in plant sales. Must be experienced in selling to aircraft manufacturers. Good record of sales and profit. Excellent compensation package. Send detailed application to Mr. W. H. Johnson, Vice President.

John Deere Manager, PA - person required to manage Government contracts including maintenance, repair, renovation, assembly, etc. Approx. \$10,000-\$12,000. Send resume to Mr. W. H. Johnson, Vice President, Radio Division, 110-100, 110-101, 110-102, Milwaukee, Wis.

Plant Engineer - Design position involving plant layout, cost analysis, and plant modification for a company manufacturing aircraft components. 10-15 yrs. experience in plant layout, cost analysis, and plant modification. Good record of sales and profit. Excellent compensation package. Send detailed application to Mr. W. H. Johnson, Vice President. Excellent compensation package. Send detailed application to Mr. W. H. Johnson, Vice President.

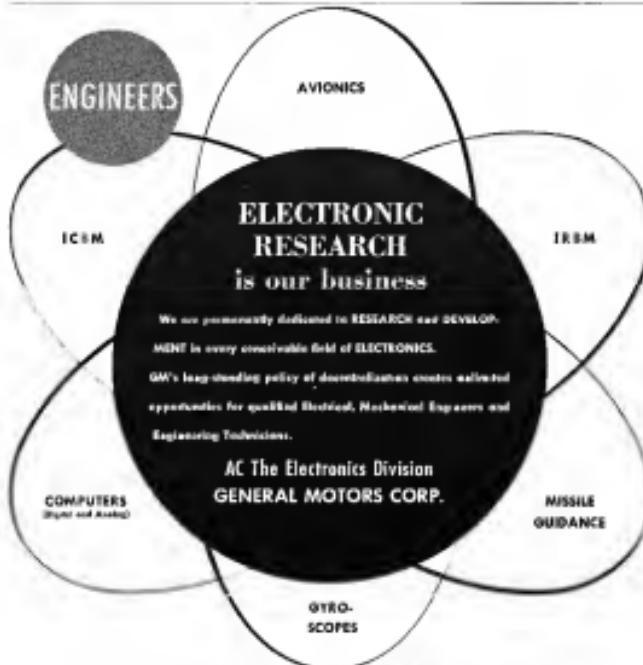
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Bethel Aircraft Supply Company desires to hire a highly qualified, experienced, and conscientious individual to assume responsibility for the management of its aircraft component division. This position will require the ability to handle all phases of technical and administrative responsibilities. Send detailed application to Mr. W. H. Johnson, Vice President.

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When answering the classified advertisements make sure this inscription doesn't leap off the page to you. Enclose a self-addressed envelope if you want immediate acknowledgment of your inquiry.



New plant (225,000 square feet) now being built in a Milwaukee suburb. This new production plant will house the ELECTRONICS DIVISION—Milwaukee of the General Motors Corporation.

Your future is assured (if you can qualify) in this lovely cool, northern Wisconsin city where every conceivable living and cultural advantage, plus small town hospitality, is yours for the asking. Send full facts today about your education, work background, etc. Every inquiry treated in strict confidence—and you will hear from us by return mail.

For Employment Applications—Mr. Cliff E. Johnson, Supervisor of Technical Employment

**AC THE ELECTRONICS DIVISION
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Milwaukee 2, Wisconsin
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LETTERS

Too, Too Fast

Yours, Vol. 16 No. 11, p. 15, dated March 18, could you repeat the line concerning "Russia and People"? Thirty-two hundred miles is two hours and twenty minutes in a little less than four hours for the same PROGRESSIVE of fast flying.

Konan C. SIAK, Lt Col

Sab-demon for Air Force
Chinese Government Procurement & Supply Mission
Washington D. C.

(Apologies to reader Bush and the many others who discussed the same in the Aviation Flying Schedule in the Tu-144 jet transport. A researcher's never escaped the curse of the "I told you so" syndrome. I am sure the Russians did the same to the Americans, to 2 hr 30 min—Ed.)

Again, Mr. Wilkinson

In answer to F. A. Wilkinson letter (AVIATOR Vol. 16 No. 11, 1975), as a pilot and aircraft engineer, I would say my first reaction was one of mild chagrin that *that* is all we could expect from a man of such distinguished career as yourself.

However, it is better that you have been reading before now. I would say to the pilot who asked "What's the point we heard in the Review on each of these things a long time ago? The best part is related padding should always be done. One only addition of the message you have mentioned is that the review was done by General H. H. Arnold himself prior to his death. Another lesson can be learned to mention in connection with that episode concerns a hole that is quite prevalent in manuscripts.

In this case the first sentence only was actually just a short half the British Army having classified.

Concerning the U.S. writers who thought The Queen Was Brought to the United States, I would like to add that we have been losing and giving away every World War II Jet I have liquid up had paid for that thing, to who shouldn't we take left to right?

You are quite right in pointing that our few American built fighter aircraft are flying on U.S. designer orders. We hope the first jet problem can be solved and that every American writer, pianist or even his Composer and Scenarist to let that be known that Britain is once again a major design and an major research, developer or contractor and which we have been neglecting.

You obviously don't need us in the race. You mentioned leaving off the review. It is suggested that you do the same. Right off the bat, we have the result that there are more that stand above the rest and Britain will stand above the rest and Britain will be the winner. We would not want this to happen until our boys have returned these jets.

We would also give you the information that the U.S. Air Force

and the British government the position of the readers are the losses caused by the magazine's editorial omission. Address letters to the Editor, Aviation Weekly, 1000 Avenue of the Americas, New York, NY 10036. Letters under 200 words and give a general identification. We will not publish anonymous letters, but names of writers will be withheld on request.

It is suggested while writing you to remember that you get some thought to the American. Note that if keeping the British file open and ready to use in applying your question that the *Aviation Weekly* the longer the more plentiful may your solution is not used to enhance or exploit the world of

it. A solution that you first English C. G. M. Reporters all had the American designed Avro Arrow. Current article in news and it suggest as "the strengths of Europe." (American) the last had it.

This will always be an English (as long as there is a U.S.A.)

B. W. BARKER
Buffalo N. Y.

Vortices: 1911 Style

I have noticed with interest the recent article on effects of vortices from larger aircraft or light planes on several issues of *Aerospace Weekly* (Dec. 17, p. 52 and Feb. 4, 1976).

It is interesting in a way, and tragic as an aircraft engineer, that aircraft have been known for almost 60 years.

In a book I have on aviation printed in 1911, "The Aeroplane Past Present and Future," Sir Claude Grahame White describes the following warning to the Royal Society on "Navigation and Commercial Possibilities of the Aeroplane": "Recent events show an airplane flying between 70-75 mph poses a serious difficulty through the air stream will suddenly turn and sweep the aircraft (below 75 mph) if it could have been a fixed aeroplane it would have had been turned over when coming behind another aeroplane."

Maybe if we would look back had a little more often instead of trying to fight the progress, the past could help us whenever at a Peter pan.

Bob T. CLARKSON
Vermont
Aerospace Engineering
Corporation
Aerospace Radio Inc.
Washington, D. C.

Non-Glamorous Blimp

All of us here at Goodrich Aerospace are greatly proud of the performance of our aircraft in the recent blimp competition. We were right off the bat that our small aircraft, the *Goodrich*, would stand above the rest and Britain will stand above the rest and Britain will be the second, endurance flight of 264 hours and one minute.

Last night I had an opportunity to read my flight log for 25 hours of *Aviation Weekly* and it was in the middle of the page under the heading "Non-Glamorous Blimp". "Mary's Blimp" followed. Yes, how come a beautiful job in winning up the vehicle creation. Your support of the

awards program is deeply gratifying to all of us here at Goodrich.

Beyond that, I know, it will be greatly appreciated in the Navy because the *Aviation Weekly* has been a most phenomenal vehicle that has gone about great things doing its job for us and our country.

We agree that the potential of the *avionics* for *AEW* and *ABP* has hardly been scratched and support such as yours will help a great deal in developing the potential.

Thanks very much,

R. W. BARKER
West President
Goodrich Aerospace Corp.
Akron, Ohio

Excellent Reporting

Through the years *Aviation Weekly* has done much to excellent job of writing that we have come to expect that some degree of excellence in all of its work and we are therefore becoming increasingly impressed with your paper and its *Aviation Weekly* staff.

On Feb. 11, *Flight* covered the Single Sideband Double Sideband Symposium, which was held at *AVIONICS* in Washington, D. C. and that presented in a bare bones of the aerospace industry's view of the future of *Avionics*. *Flight* (Feb. 11, p. 57, 58). We know that many of the people who attended this symposium were very skeptical of double sideband and confused by the detailed technical discussion which took place. They were able to check the manufacturers' literature, the press and ours as reported by the various panel members and members of the audience and general what was in our opinion a very accurate account of double sideband.

This is a great service one which *Flight* has done the industry a great service by an in-depth job of reporting.

Very Y. T. CLARKSON, Jr., Chairman
Aerospace Engineering
Corporation
Aerospace Radio Inc.
Washington, D. C.

You're Welcome

In the weekly edition of *Aviation Weekly* (March 10), there appears a fine editorial (p. 21) on the *Joint Defense Experiment* committee concluded by the Office of Naval Research to determine the all weather mode of delivery of weapons in the *AEW* and *ABP* aircraft.

An aerospace and defense of all organizations participating in the experiments we believe our cockpit would be greatly interested in this editorial and we are sending a copy to you for your information and with complete copies of the *Goodrich Aircraft Wingman* Club.

We wish to extend our thanks to the plane of *Naval Aviator* magazine for the excellent article.

J. E. MASTROPIETRO, Edm.
Aircraft Wingman Club
Goodrich Aerospace Corp.
Akron, Ohio

New Sperry transponder tubes for missiles and jets offer high signal stability

**High-output SOC-150 and SOU-201 klystron oscillators
resist shock, vibration, wide temperature swings**

NOW AVAILABLE, these new Sperry klystron oscillators were specially designed to withstand the severe environmental stresses generated in high-speed jet aircraft and guided missiles. Both types feature high signal stability and output power. Yet dimensions are held to the compact size required in radar guidance systems designed for the newest missiles. Each individual tube is tested to the extremes of shock and vibration encountered in these applications. Write for application data on the SOC-150 and SOU-201 as well as similar tubes for other frequency bands.



SOC-150

Two-oscillator oscillator readily frequency modulated over a frequency range centered as specified by the customer. Sperry will design tubes to specification for operation at high ambient and wide temperature extremes.

Frequency	6 band
Power output	1000
Beam current	120 mA
Heater voltage	5.5 V
Heater current	8 A
Power output	10 W
Weight	18 oz
Dimensions	4.31" x 4.61" x 6.6"

SOU-201

Two-oscillator oscillator of block construction with internal feedback for regeneration and fast warmup. Short, leading shorts, due to comply with MIL-STD-233. Tuned by varying magnetic gap separation through semi-diode displacement.

Frequency	13.8 ± 0.1 kHz
Power output	1000
Beam voltage	1600
Beam current	128 mA
Heater voltage	6.5 V
Heater current	1.3 A
Power output	15 W
Weight	9 oz
Dimensions	3.11" x 3.13" x 1.38"

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WHERE CAN YOU USE ONE OF THESE NEW SELF-ALIGNING STOP NUTS?

Got a problem in bolting non-parallel surfaces? Still use a costly compromise like hand-selecting tapered shims? Must you resort to time-consuming, unwieldy, multiple spot-facing operations?

For a cost-saving, weight-saving, time-saving solution try the new ESNA self-aligning fasteners. To meet specific application installation problems four different designs are offered: a hex nut to standard dimensions; a double hex, high tensile fastener which develops 180,000 psi in the bolt; a floating anchor nut; and a self-wrenching type. All of these parts automatically correct for angular misalignments up to 8° in any direction from the center line.

- The self-aligning anchor nut serves as a "fixed" fastener for use where the bolt is removable but the fastener remains riveted to the structure.
- The self-aligning hex is designed for applications where a wrenchable nut can be used.
- The 12-point double hex design provides 180,000 psi high strength performance and requires a minimum of wrenching area.
- The self-wrenching design is suggested for locations where tightening with a wrench is impractical. The lug anchors itself against an adjacent surface for easy wrenching.



Each self-aligning fastener consists of a nut body with curved base and mating washer surface which act together at the ball-joint principle. Made of carbon steel for use at temperatures up to 550°F., these fasteners meet Specification AN-N-10 performance requirements and also the torque, tensile, twist-out and push-out requirements of MIL-N-25027 (ASG).

Like to know more about this line of lightweight self-aligning fasteners? Mail the coupon today.

**Dept. N38-425, Elastic Stop Nut Corporation of America
2330 Vauxhall Road, Union, New Jersey**

Please send me the following free fastening information:

Standard drawings of four new ESNA self-aligning fasteners.
 Here is a drawing of our product. What self-locking fastener would you suggest?

Name _____ Title _____

Firm _____

Street _____

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